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RADIO ENGINEERING SYSTEM OF SHORT-RANGE NAVIGATION.
RSBN-2

by

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FOREIGN TECHNOLOGY DIVISION

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Chapter V

GROUND-BASED DISPLAY UNIT.

Plan position indicator (Fig. 87) is intended for determining azimuth and slant range of aircraft, equipped with onboard equipment BSBN-2s and which are located in the zone of action of beacon, and their individual identification with radio communication.

For obtaining marks from aircraft on screen PPI is utilized the principle of active radar, which makes it possible to remove illumination from the ground features.

Display unit consists of:

the unit of signals PPI (unit of SI);

unit PPI;

the unit of high-voltage rectifier (unit it wove);

the unit of rectifier PPI (unit VI).

Functional diagram (Fig. 88). The directional azimuth antenna, rotating at a rate of 100 r/min, consecutively irradiates all aircraft, which are located in the zone of action of radio beacon.

From the electromagnetic sensor of the column of the drive of azimuth antenna by the transmitter P-20D through the omnidirectional antenna it transmits 180 inquiring signals in one turn of antenna (frequency of demand 300 Hz).

These signals, following through each of 2° rotation of antenna, start radial time base PPI. Furthermore, on PPI enter the voltages from the selsyn transmitter BS-2, mechanically connected with azimuth antenna. These voltages form/shape the signals, proportional to the

sine and the cosine of the angle of rotation of azimuth antenna.

The inquiring signals, emitted by the omnidirectional azimuth antenna, are received as aircraft receivers. From all taken signals is isolated only that, that follows immediately the azimuth. This signal it passes through entire on-board circuit and in the form of response indicator signal transmits to the earth SZD or SOD.

Accepted by NPU response signals are decoded and are supplied in PPI on which they appear brightness marks from aircraft. The angular position of mark corresponds to the azimuth of aircraft, and distance from the center of the screen of NKO [99mp3 - People's Commisariat of Defense] to mark is slant ranges. For convenience in the reading on screen are created the markers of azimuth (2°, 10° and 30°) and of range (10 and 50 km). Ten-degree markers are form/shaped from reference pulses "36" and are corrected by two-degree momentum/impulse/pulses. Page 105.

Fig. 87. The cabinet of the display unit: 1 - the unit of signals; 2 - unit the PPI: enf is a unit of rectifier H.E.B.V.; 4 - the unit of high-voltage rectifier.

Fig. 88. Functional diagram of display unit.

Key: (1). Receiving part. (2). Adapter. (esf). Circuit of isolation/liberation. (4). Transmitter. (5). Measuring unit of azimuth and range. (6). Complete version. (7). Simplified version. (8). disk. (9). Northern disk. (10). Rotator.

The thirty-degree markers of azimuth are obtained by the division ten-degree. Range marks are form/shaped in the unit of SI from the two-degree momentum/impulse/pulses, which start scanning/sweep. PPI has two scales of the scanning/sweep: 100 and 400 km (Fig. 89).

Since the velocity of the rotation of azimuth antenna and frequency and the frequency of inquiring two-degree signals are synchronized, on screen PPI is obtained stable picture and the maximum fault of measurement of azimuth it does not exceed 2°. Performing flight with the section of azimuth, aircraft in this case as "bounced" on motionless inquiring markers (inquiring signals). Occurs this for the following reason. After irradiation by antenna the aircraft accepts the two-degree inquiring signal, which simultaneously starts radial scanning PPI, and immediately transmits response signal. However, since on screen PPI radial scanning is

repulsed through two degrees, then response signal it will come during two degrees of flight to the one and the same two-degree radial marker of azimuth, which serves as inquiring signal during the flight/span of these two degrees. With the reception of the following inquiring signal the marker immediately jumps to the following two-degree radial marker of azimuth. Hence it follows that at the initial moment of approach to marker the measuring error of azimuth is equal to zero, and subsequently torque/moments abruptly it increases to two degrees, whereupon again it decreases to zero, etc. This is explained by Fig. 90. For a decrease in this fault of measurement of azimuth are introduced the different delays in aircraft circuit (3°) and in display unit (4°). As a result any measured azimuth differs from the true not more than by 1°.

The application/use of a method of active radar and coding make it possible to raise freedom from interference, since are removed illumination from the ground features and the effect of the lateral lobes of the radiation pattern of azimuth antenna.

In display unit for the correct orientation of image along azimuth is utilized the mark from KVP, which is obtained just as mark from aircraft. In view of the fact that the KVP is placed on the

azimuths, multiple 10°, but markers in display unit are shifted by 4°, on screen ·: mark from KVP it is arrange/located on azimuth to 4 less corresponding ten-degree markers.

With the coincidence of the ten-degree marker of the electronic display scale, on which is established/installed the antenna KVP, with the appropriate ten-degree marker, placed on dial device, is oriented image KVP with its true position in locality. As a result the northern direction of the electronic scale corresponds to true northern direction.

Marker from KVP is delayed in the unit of SI to 400-500 μss (60-80 km) and is visible in the form of line.

end section.

Fig. 89. Form of screen the PPI: a) scale 100 km; b) scale 400 km: 1 - mark of KVP; 2 - mark of aircraft.

Unit of the signals of plan position indicator.

This unit form/shapes the trigger pulses of radial scanning, range mark (10 and 50 km), wide brightness momentum/impulse/pulses and momentum/impulse/pulse from KVP, and also it mixes markers and momentum/impulse/pulses.

Functional diagram (Fig. 91) consists of the following channels: the formation and delays in the two-degree signals, the formation of the range marks, formation of the expanded videosignals, formation of the expanded videosignal of marginal post, formation of azimuth markers.

Fig. 90. Curve/graph of error distribution during the measurement of azimuth.

Key: (1). Equal delays. (2). Measuring error, deg. (emi). Unequal delays. (4). Azimuth deg. Channel of formation and delay in the

two-degree momentum/impulse/pulses. The two-degree momentum/impulse/pulses, which come in from the unit of WDA, approacn the blocking oscillator, from output/yield of which are supplied to cathode follower, and then to delay line (47.6 μss). The need for the introduction of this line is caused by the fact that with the decoding of inquiring and response signals appears the constant delay in the circuit of ranging, i.e., appears constant range error. For the elimination of this error is realized a delay in the starting/launching cf scanning/sweep on 47.6 μss.

After passage through line of delay two-degree momentum/impulse/pulses start the second blocking oscillator. Formed with blocking oscillator momentum/impulse/pulses are supplied to cathode follower and then through the coupling P_2 to the triggering of scanning/sweep PPI.

Furthermore, from the output/yield of blocking oscillator the momentum/impulse/pulses enter the channel of the formation of range marks and into the cascade/stage of the agreement of the channel of division and formation of azimuth markers, employed for the exception/elimination of the effect of the fluctuations of the two-degree and ten-degree momentum/impulse/pulses, which can occur as

a result of impulse shaping, and also as a result of an inaccuracy in their mutual adjustment.

Channel of the formation of range marks. From the output/yield of the blocking oscillator of the forming channel the delayed two-degree momentum/impulse/pulses approach buffer amplifier, electronic relay and for the starting/launching of shock-excited oscillator. The obtained sinusoidal oscillations whose frequency is 15 kHz and whose amplitude is 60 in are restricted to diode limiter and amplifier-limiter.

From the output/yield of amplifier-limiter are removed the positive pulses with repetition frequency 15 kHz, by which is started the blocking oscillator, which forms the 10-km of range mark. These markers approach the blocking oscillator, which forms the 50-km of range mark, and to electronic thermal expansion relay the 10-km of markers. the 50-km of range mark from blocking oscillator are supplied to electronic thermal expansion relay. After expansion 10 and 50 km of range mark mix themselves in mixer with all pulses formed in the unit of SI.

Channel of the formation of the expanded momentum/impulse/pulses. Pulse widening is necessary for an increase in the brightness of marks. Depending on the scale of scanning/sweep, the pulse duration must be the different for obtaining on screen PPI mark of the necessary brightness. So, on scale 100 km pulse duration must be 5.5 μss, and on scale 400 km must 19.0 μss.

Momentum/impulse/pulses from unit Lake approach buffer amplifier and to electronic thermal expansion relay. The expanded momentum/impulse/pulses are supplied to mixer. Between the electronic thermal expansion relay and the mixer is provided the d. c. restoration circuit.

Channel of the formation of the expanded momentum/impulse/pulse of KVP. From the unit of the adapter of supervisory equipment the momentum/impulse/pulse KVP is supplied to buffer amplifier, the electronic relay of delay and electronic thermal expansion relay. From the output/yield of the last/latter relay the momentum/impulse/pulses of KVP mix themselves in mixer with other momentum/impulse/pulses. Page 108.

Fig. 91. Functional diagram of the unit of SI. Key: (1). Channel of the formation of range marks. (2). Buffer amplifier. (emf). Electronic relay. (4). Shock-excited oscillator. (5). Diode limiter. (6). Amplifier-limiter. (7). Blocking oscillator the 10-km of markers. (8). Electronic thermal expansion relay the 10-km of markers. (9). Division 50 km. (10). Blocking oscillator. (11). Cathode follower. (12). Delay line on 47.6 μss. (13). Blocking oscillator. (14). Cathode follower. (15). Starting/launching of scanning/sweep. (16). Cascade/stage of restoration/reduction with constant component. (17). Channel of formation and delay in the two-degree signals. (18). Two-degree signal. (19). Videosignal. (20). Buffer amplifier. (21). Electronic thermal expansion relay. (22). Mixer. (23). Channel of the formation of the expanded videosignals. (24). Brightness. (25). Video are extension signal. (26). Buffer amplifier. (27). The electronic relay of delay. (28). Electronic thermal expansion relay. (29). Videomodulation. (30). Channel of the formation of the expanded videosignal of KVP. (31). Ten-degree signal. (32). Buffer amplifier. (33). The electronic relay of shift/shear. (34). Buffer amplifier. (35). The electronic relay of width. (36). Cascade/stage of agreement. (37). Buffer amplifier. (38). Multivibrator of duration. (39). Division 30°/ (40). The electronic relay of duration 30°. (41). Duration of markers 30°. (42). Shift/shear of markers. (43). Limitation. (44). Corrective cascade/stage. (45). Buffer amplifier. (46). The electronic relay of

duration 10°. (47). Channel of the formation of azimuth markers. (48). Northern signal. (49). Duration of markers 10°. Page 109.

Channel of the formation of azimuth markers. From the unit of WDA the reference pulses "36" (ten-degree momentum/impulse/pulses) are supplied to the buffer amplifier, from output/yield of which they are passed through the electronic relay of shift/shear to 4° in the direction of the rotation/revolution of azimuth antenna (for a decrease in the maximum fault of measurement of azimuth) and are fed to the following buffer amplifier. The intensive momentum/impulse/pulses start the electronic relay of width, which expands momentum/impulse/pulses to 16 μss. The obtained wide momentum/impulse/pulses approach the cascade/stage of coincidence, to which are supplied the delayed two-degree momentum/impulse/pulses. Shift by 4° ten-degree momentum/impulse/pulses of the cascade/stage of coincidence through the buffer amplifier move to division circuit into three. The obtained momentum/impulse/pulses with frequency 20 Hz and amplitude 50 in approach the electronic relay of duration. The duration of thirty-degree markers can be regulated.

Ten-degree momentum/impulse/pulses from the cascade/stage of the agreement through the buffer amplifier start the electronic relay of

the duration of ten-degree markers. The duration of these markers can be regulated. The expanded thirty- and ten-degree markers of azimuth are supplied to mixer. From the output/yield of mixer all markers enter PPI.

Schematic diagram (Fig. 92). Channel of formation and delay in the two-degree momentum/impulse/pulses. The two-degree momentum/impulse/pulses, which enter from the unit of WDA, are supplied to the blocking oscillator, assembled on the tube of L_{11} (6N1P) and which works in the mode/conditions of self-excitation with repetition frequency 80 Hz. Two-degree momentum/impulse/pulses synchronize its frequency. From the output/yield of the winding of transformer Tp_3 are removed the momentum/impulse/pulses 300 Hz frequency, which are supplied to the grid of the cathode follower, assembled on the left half of the tube of L_{12} (6N1P). Displacement of the control electrode of the left half of the tube of the L_{11} of blocking oscillator enters from divider/denominator R_{51}, R_{52}, and to the grid of cathode follower - from divider/denominator R_{62}, R_{63}, connected the negative pole of power supply - 180 in.

With the load of the cathode follower R_{54} the momentum/impulse/pulses go to the delay line in the LZ-1, where they

are delayed on 47.6 μss, whereupon they start the forming blocking oscillator, assembled on the tube of L_{13} ('NYP). Passed through delay line and formed by blocking oscillator two-degree momentum/impulse/pulses through the cathode follower, assembled on the right half of the tube of L_{14} (6N1P), are supplied on cable for the starting/launching of scanning/sweep. This circuit provides the starting/launching of scanning/sweep PPI synchronously with the rotation/revolution of azimuth antenna.

In the absence of two-degree momentum/impulse/pulses from the unit of WDA the trigger circuit of scanning/sweep will wear/operate with frequency 80 Hz from the first blocking oscillator (tube of L_{11}). For the monitoring of the momentum/impulse/pulses, which start scanning/sweep, is provided the seat/socket G_1. Resistance R_{59} decreases the effect of monitoring oscillograph on the work of circuit.

Channel of the formation of range marks. From the winding of 2-5 transformer Tp_4 blocking oscillator on the tube of L_{13} two-degree momentum/impulse/pulses are supplied through capacitor C_1 and resistance R_2 to the grid of the buffer amplifier, assembled on the left half of tube L_1 (6N1P). The intensive negative pulse starts the

circuit of the electronic relay, assembled on tube L_2 (6N1P). The momentum/impulse/pulse, developed by the circuit of electronic relay, must take rectangular form with abrupt/steep front/leading and trailing edges, since on scale 400 km the pulse duration of the circuit of expansion must be 2700 μss, and the time between consecutive trigger pulses equal to to 3300 μss consequently, for a period of the restoration/reduction of circuit comes a total of 600 μss. For achievement of this recovery time into the circuit of the communication/connection between the anode of the right half of tube L_2 and the grid of the left half of tube L_2 is included the cathode follower, assembled on the right half of tube L_1, who ensures the rapid recharge of coupling capacitor C_3, improving the slope/transconductance of trailing edge of pulse. Furthermore, into anode value electronic relay L_2 is included tube L_{31} (double diode the 6X2P), which decreases the time of the restoration of circuit because of the limitation of the drop of the anode voltage in the beginning and at the end of the momentum/impulse/pulse, caused by parasitic interelectrode grid capacitances - anode. Pages 110-111.

Fig. 92. Fundamental circuit of the unit of SI.

Key: (1). Circuit. (2). Housing. (emf) Hz. (4). V. (5). Videoes. (6). North. (7). marker. (8) marker. (9). Videoes Byn. (10). Videoes of modes. (11). Starting/launching. (12). Housing. Page 112. The obtained momentum/impulse/pulses through capacitor C_5 start shock-excited oscillator on tube L_3 (6N1P). In circuit of the grid of this oscillator is included guiding the half of tube L_4 (6X2P) for the shunting of positive pulses.

Shock-excited oscillator with duct C_4, C_6, L_1 in the cathode of tube generates the sinusoidal sustained oscillations 15 kHz frequency. The period of variation of frequency 15 kHz corresponds to distance 10 km. From the part of the turns of inductance coil L_1 through resistance R_{14} oscillation they are supplied to the cascade/stage of limitation, made on the left half of tube L_4 (6X2P). The negative half-waves of sine voltage from this cascade/stage start the cascade/stage of peaking, assembled on tube L_5 (6J1P). Because of the inclusion into the anode circuit of inductance coil L_2, the cascade/stage generates one pointed momentum/impulse/pulse during the action of negative half-wave.

The pointed positive pulses, removed from plate load R_{18}, through capacitor C_8 and the buffer stage, assembled on the left half of tube L_6, start the blocking oscillator, made on the right half of tube L_6 (6N1P). Blocking oscillator form/shapes the 10-km of the range mark, which from the winding of 2-5 transformer Tp_1 through capacitor C_{11} are supplied to buffer stage on the left half of tube L_8 (6N1P), and then to the cascade/stage of expansion. From divider/denominator R_{23}, R_{22} through capacitor C_{13} and resistance R_{27} the momentum/impulse/pulses 6 μss wide approach the buffer stage, assembled on the left half of tube L_7 (6N1P). On the right half of tube L_7 is assembled the blocking oscillator, which works in the mode/conditions of division so that it is started by each fifth 10-km by the momentum/impulse/pulse, which enters from buffer stage. From blocking oscillator the momentum/impulse/pulses through the buffer amplifier, assembled on the right half of tube L_8 (6N1P), are supplied to the cascade/stage of expansion the 50-km of markers on the tube of L_{10} (6N1P).

Momentum/impulse/pulse from blocking oscillator creates during the anode resistance R_{39} the buffer stage, which is simultaneously the load of cutoff tube L_9 (6N1P) the cascade/stage of expansion, high-amplitude momentum/impulse/pulse, which starts cascade/stage of expansion. This cascade/stage is assembled according to the circuit

of the waiting multivibrator with the cathode resistance coupling R_{38}. In the absence of trigger pulse the right half of tube L_9 is unlocked, since its grid is connected through the high resistance R_{42} to source +180 in. The incoming negative pulse cuts off the right half of tube L_9. In this case from resistance R_{38} is removed the cutoff voltage and the left half of tube L_9 is triggered. The voltage drop across resistance R_{42}, caused by the discharge current of capacitor, supports the right half of tube L_9 in the closed state and after completion of the action of momentum/impulse/pulse until voltage falls to the potential of the triggering of tube. Only after this the circuit of the cascade/stage of expansion abruptly returns to the initial state. Thus on plate load R_{40}, R_{41} are obtained the positive, almost square pulses whose duration depends in essence on constant time value C_{16}, R_{12}. The circuit of expansion on the tube of L_{10} works analogously described.

Expanded 10 and the 50-km of range mark through capacitors C_{15} and C_{19} are supplied to mixer.

Channel of the formation of the expanded momentum/impulse/pulses. Momentum/impulse/pulses from unit Lake through block capacitor C_{54} approach the inlet of the buffer

amplifier, assembled on the left half of the tube of L_{19} (6N1P).

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In the grid of circuit of buffer stage is included the diode for shunting of negative pulses. Momentum/impulse/pulses start the electronic relay, assembled on the tube of L_{20} (6N1P) whose work is analogous to the work of the cascade/stage of expansion on tube L_9. The pulse duration, form/shaped by electronic relay, depends on the selected scale of scanning/sweep and is determined by the time constant of circuit C_{28}, R_{93} or value C_{28}, R_{93}, R_{96}, R_{98} - with respect 5.5 or to 19.0 μss.

During switching the scales of scanning/sweep wear/operates relay P_1, which by its contacts shunts resistances R_{96}, R_{98}, thereby changing pulse duration.

From plate load R_{92} the positive pulses through capacitor C_{27} approach the inlet of the cascade/stage of mixer. In connection with the fact that the signals from aircraft go with different intervals

from each other, on capacitor C_{27} there can be different residual charge, that it would lead to a change in the displacement on the grid of mixer, i.e., to a change in the brightness of marks. For the elimination of this phenomenon into channel is introduced the d. c. restoration circuit on the right half tube of L_{18} (6X2P). During the transmission of the expanded momentum/impulse/pulse the accumulated on capacitor, charge leaks off through the diode.

Channel of the formation of the expanded momentum/impulse/pulse of KVP. Momentum/impulse/pulse KVP from unit PU through capacitor C_{29} is supplied to the grid of the closed buffer stage, assembled on the right half of the tube of L_{19} (6N1P), and then to the electronic relay of delay on the tube of L_{21} (6N1P). The circuits, assembled on the indicated tubes, are analogous to the circuits, assembled on the left half of the tube of L_{19} and the tube of L_{20}. Tube L_{21} delays momentum/impulse/pulse KVP on 400-500 μss (60-80 km).

In plate load R_{102} the electronic relay of pulse delay the KVP through capacitor C_{30} enters in the diagram of the electronic relay of width on the tube of L_{22} (6N1P). The negative pulse, obtained as a result of differentiation of the trailing edge of input pulse, starts this electronic relay. Circuit works analogous with the circuit of

the electronic relay of delay. Electronic relay on the tube of L_{22} issues momentum/impulse/pulse by duration 41 or 16 μss depending on the scale of scanning/sweep. During switching the scales of scanning/sweep wear/operates relay P_1 and is closed resistance R_{109}. Thereby is changed the time constant of circuit C_{31}, R_{109}, R_{110}. The obtained momentum/impulse/pulses of KVP enter through capacitor C_{33} to mixer.

Channel of the formation of azimuth markers. The formed in the unit of WDA reference pulses "36" (ten-degree markers) through the knife coupling P_2 and capacitor C_{35} are supplied to the grid of the closed buffer stage, made on the right half of the tube of L_{12} (6N1P). Positive pulse open/discloses tube, and in plate load R_{117}, which is simultaneously the load of cascade/stage on the tube of L_{23} (6N1P), appears the negative pulse, which starts the electronic relay of shift/shear. Cascade/stage on the tube of L_{23} is made according to the circuit of the waiting multivibrator with common/general/total cathode resistance. His work is described earlier.

The electronic relay of shift/shear develops the square pulse (5-10 μss), which corresponds to shift/shear 3-6°. From plate load R_{117} the electronic relay of the shift/shear through capacitor C_{38}

the momentum/impulse/pulses are supplied to the grid of the buffer stage, assembled on the left half of the tube of L_{14} (6N1P), and then to the circuit of the electronic relay of width on the tube of L_{24} (6N1P). Capacitor C_{38} and resistance R_{119} differentiate the delayed ten-degree momentum/impulse/pulse. The delay time in the momentum/impulse/pulse, i.e., the shift/shear of markers, is realized by potential changing on the grid closed tube of L_{23} by potentiometer R_{113} whose spline is derived on the front/leading panel of unit with inscription the "shift/shear of markers".

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Tube L_{24} is started by the trailing edge of the differentiated momentum/impulse/pulse. From load R_{123} cascade/stage is removed the momentum/impulse/pulse by duration of approximately 1.66 μss (1°), that ensures the normal operation of the cascade/stage of coincidence during the possible fluctuations of both incoming momentum/impulse/pulses. To the cascade/stage of agreement on the tube of L_{25} (6X2P) are supplied the wide, delayed to 6.6 μss ten-degree momentum/impulse/pulses from load R_{123} and the delayed on 47.6 μss two-degree momentum/impulse/pulses from the winding of 2-5 transformer Tp_4. The incoming momentum/impulse/pulses are summarized

during resistance R_{127}. Both momentum/impulse/pulses can be controlled with the aid of oscillograph. the connected in seat/socket G_3 on front/leading panel unit. The left half of the tube of L_{25} is closed by the positive voltage, removed from potentiometer R_{125} whose spline is derived on front/leading panel with inscription "limitation".

The potential of the cathode of the left half of the tube of L_{25} is selected so that the tube is opened only if the total pulse amplitude exceeds voltage on cathode, i.e., there is the agreement of both momentum/impulse/pulses. Limitation level is checked with the aid of the oscillograph, connected in seat/socket G_5.

From load R_{126} cascade/stage of agreement are removed the ten-degree momentum/impulse/pulses, which coincide in time with two-degree, that synchronize the work of entire display unit. These momentum/impulse/pulses, shifted on 6.6 μss (4°), are supplied through capacitor C_{44} to the buffer stage, made on the left half of the tube of L_{26} (6N1P) and which is the waiting multivibrator with the grounded cathode. Cascade/stage works in the mode/conditions of division into three.

From load R_{139} multivibrator are removed the positive square pulses whose duration it is possible to change within limits 30-50 μss (20-30°) by potenticmeter R_{141} with label the "division of markers 30°". Pulse durations it is possible to check during seat/socket G_4 the "monitoring - division is 30°".

The phase of thirty-degree momentum/impulse/pulse is determined by the phase of northern momentum/impulse/pulse. For this purpose in the circuit of the unit of SI is utilized the corrective cascade/stage, assembled on the right half of the tube of L_{28} (6N1P). Cascade/stage is closed by the negative displacement, supplied from divider/denominator R_{143}, R_{144} through resistance R_{145}. The load of cascade/stage is the resistance R_{139}, common/general/total for the right halves of tubes L_{28} and of L_{27}. The formed in unit WDA positive northern momentum/impulse/pulse through capacitor C_{47} is supplied to the grid of the closed corrective cascade/stage. On the plate load of cascade/stage appears the negative pulse, which through capacitor C_{45} is supplied to the grid of the left half of the tube of L_{27} and cuts off it. however, since the ten-degree momentum/impulse/pulses, which start this tube, are shifted on 6.6 μss relative to northern momentum/impulse/pulse, then after the closing of tube by northern

momentum/impulse/pulse the following ten-degree momentum/impulse/pulse it comes through 6.6 μss. From this momentum/impulse/pulse begins the process of division into three. As a result the thirty-degree markers of azimuth begin always from zero (northern) direction.

Positive pulses from the load of the multivibrator through capacitor C_{48} are supplied to the grid of the buffer amplifier, assembled on the left half of the tube of L_{28} (6N1P). The obtained on load R_{151} momentum/impulse/pulse starts the electronic relay, which form/shapes positive square pulses by duration 2700 μss, also, with frequency 20 Hz, which correspond to thirty-degree markers. Momentum/impulse/pulse by duration 2700 μss is intended for the illumination of thirty-degree azimuth markers. From the load of electronic relay the positive pulses through capacitor C_{49} approach mixer. Page 115.

Fig. 93. Unit of SI: 1 potentiometer of the brightness control of the marker of KVP; 2 - the potentiometer of brightness control the 50-km of markers; emf - the potentiometer of brightness control the 10-km markers; 4 - hours; 5 - the potentiometer of the brightness control of thirty-degree markers; 6 - the potentiometer of the brightness control of ten-degree markers; 7 - the adjustment knob of the brightness video markers; 8 - the potentiometer of division the 50-km of markers; 9 - the potentiometer of the division thirty-degree markers; 10, 11, 12, 13, 14 - monitoring jacks; 15 - the potentiometer of the adjustment of the duration of thirty-degree markers; 16 - the potentiometer of the adjustment of the duration of ten-degree markers; 17 - the potentiometer of the adjustment of the shift/shear of markers. The ten-degree azimuth markers, obtained during resistance R_{125}, are passed through the cascade/stages, made on the left half of the tube of L_{26} (6N1P) and the tube of L_{30} (6N1P), and througn capacitor C_{51} from part of load R_{161} they are supplied to mixer. In circuits is provided the possibility of the manual adjustment of the duration of ten-degree and thirty-degree markers. The splines of potentiometers are derived on the front/leading panel of unit with labels the "duration of markers 10°" and the "duration of markers 30°".

All momentum/impulse/pulses, formed in the unit of SI, mix

themselves and on cable are supplied to unit PPI for modulation of the electron beam of tube.

Mixer is made on the tubes of L_{15}, L_{16}, L_{17} (6N1P) according to the circuit of the cathode followers, interconnected. By changing displacement on the grid of each cathode follower, it is possible to regulate the amplitude of the corresponding momentum/impulse/pulse. The knob/sticks of the potentiometers, which control the displacement of tubes, are derived on the front/leading panel of unit. For the monitoring of the mixed momentum/impulse/pulses on the front/leading panel of unit derived monitoring jack G_2.

Constructions. Unit (Fig. 93) is assembled on right-angled chassis/landing gear. From behind unit is a knife coupling for the connection of power supply and alignment pins. The mounting of unit is made in the basement of chassis/landing gear.

On front/leading panel are established/installed the hours, and on it are derived the splines of the potentiometers of the brightness control of the main impulses of unit, shift/shear of markers, duration of ten- and thirty-degree markers, division of thirty-degree

markers, division the 50-km of markers. Brightness from markers from aircraft and KVP is regulated by separate/individual knob/stick. Furthermore, on front/leading panel are derived the monitoring jacks, which make it possible to check the work of unit on oscillograph.

Display unit of circular scan.

Plan position indicator is intended for obtaining on the cathode-ray tube face of marks from the aircraft, equipped with onboard equipment, and the determination of slant range and azimuth of aircraft. Page 116.

Fig. 94. Functional diagram of unit PPI.

Key: (1). Trigger pulse. (2). Channels of the formation of horizontal and vertical component scanning/sweep. (emf). Sawtooth generator. (4). Input push-pull amplifier. (5). Output push-pull amplifier. (6). Buffer amplifier. (7). Multivibrator of duration. (8). Paraphase amplifier. (9). Common/general/total diode of sawtooth generator. (10). Sweep amplitude. (11). Fixing cascade/stage. (12). Deflection coil. (13). Fixing spool. (14). Inverter cascade/stage. (15). Cascade/stage of illumination. (16). Sawtooth generator. (17). Input of push-pull amplifier. (18). Centering. (19). Fixing cascade/stages. (20). Zero-setting on vertical line. (21). Channel of the formation of the square pulses illumination. (22). Transformer of vertical comprising. (23). Cathode follower. (24). Phase discriminator. (25). Output cathode follower. (26). Videosignals and markers. (27). Amplitude of sweep voltage. (28). Sine wave oscillator. (29). Transformer of carrier frequency. (30). Indicator instrument. (31). Cascade/stage of clamping. (32). Circuit of brig''ness. (33). Brightness. (34). Transformer horizontal component. (35). Cathode follower. (36). Phase discriminator. (37). Cutput cathode followei. (38). Zero-setting on horizontal. (39). Scheme of control of cathode-ray tube. (40). 1 focus 5-th cascade/stage. (41). Focus. Page 117.

Functional diagram (Fig. 94) consists of the channels of the formation of the horizontal comprising scanning/sweep, formation vertical component scanning/sweep, formation of the square pulses of illumination and scheme of control of cathode-ray tube.

Channel of the formation horizontal component scanning/sweep. Trigger pulse from the unit of SI is supplied to the buffer stage, with the aid of which is started the multivibrator of duration. Momentum/impulse/pulse from multivibrator approaches the paraphase amplifier, from loads of which are removed two identical square pulses of opposite polarity. Square pulses start sawtooth generators, whereupon the amplitudes of sawtooth pulses change according to the law of sine and cosine of the angle of rotation of antenna. For obtaining the voltages of development/scanning, proportional to the sine and the cosine of the angle of rotation of antenna in channel is applied the circuit, which consists of sine wave oscillator, transformers, phase discriminators and cathode followers.

Sine wave oscillator creates continuous oscillations 1500 Hz frequency and it supplies the excitation winding of the noncontact

selsyn of BS-2, and also the primary winding of the transformer of carrier frequency.

From the output windings of selsyn are removed two voltages. one is proportional to the sine of the angle of rotation of azimuth antenna - horizontal component scanning/sweep, another - to the cosine of the angle of rotation of azimuth antenna - vertical component scanning/sweep.

The voltage of horizontal (sine) comprising scanning/sweep enters from selsyn to the transformer horizontal component scanning/sweep, and then to the cathode follower, which divides the circuits of phase discriminator and selsyn. Besides the voltage horizontal component scanning/sweep, to phase discriminator from the transformer of carrier frequency is supplied the voltage 1500 Hz frequency.

From the output/yield of phase envelope detector of voltage, proportional to the cosine of the angle of rotation of azimuth antenna, approaches cathode follower and from it to sawtooth generator. The obtained in pulse generator of voltage are amplified

by input amplifier, and then output push-pull amplifier. The load of push-pull amplifier is the deflection coil. After this amplifier in channel are provided the cascade/stages for fixation of the initial level of the momentum/impulse/pulses of saw-tooth voltage.

The channel of the formation vertical component scanning/sweep is analogous to the channel of the formation horizontal component scanning/sweep.

Channel of the formation of the square pulses of illumination. The formed by multivibrator square pulses start the inverter cascade/stage, which in turn, by negative square pulse cuts off the cascade/stage of illumination. At the output/yield of the cascade/stage of illumination is formed the negative square pulse, which depending on the scale of scanning/sweep has different duration. This momentum/impulse/pulse is supplied to the cathode circuit of cathode-ray tube, brightening scanning/sweep during direct/straight course of ray. For fixation of the initial level of negative pulses in channel are provided the fixing cascade/stages.

Scheme of control by cathode-ray tube consists of the circuit of

preliminary centering, circuit of brightness control with the cascade/stage of clamping scanning/sweep and fixing cascade/stage.

Schematic diagram (Fig. 95). Channel of the formation horizontal component scanning/sweep. The formed in the unit of SI trigger pulse through knife switch P_2 and capacitor C_1 is supplied to the grid of closed with negative voltage from divider/denominator R_1, R_3 the buffer stage, assembled on the left half of tube L_1 (6N1P). Pages 118-119.

Fig. 95. Schematic diagram of the block PPI.

Key: (1). Circuit. (2). housing. (emf) Hz. (4) in. (5). video complete. (6). Videoes simplified. (7). Scale. Key cont. for Page 119. (1). Vert. (2). Horiz. (emf). Vert. (4). Horizon/level. (5). Telephone. (6). Telephone. (7). Throat microphone. (8). Throat microphone. (9). Selsyn. (10). Housing. (11). Page 120.

Momentum/impulse/pulse from buffer stage starts the waiting multivibrator, made on tube L_2 (6N1P) according to circuit with the grounded cathodes and negative displacement on grid of one of the tubes. Multivibrator develops square pulses by duration 670 μss or 2700 μss depending on the scale of scanning/sweep (100 or 400 km).

During the absence of trigger pulses the right half of tube L_2 is closed by negative displacement from voltage divider R_6, R_8, R_9, and the left half is opened, since its grid through the high resistance R_5, R_4 or R_{99} is connected to source +250 in.

In the circuit of multivibrator is included cathode follower on the tube of L_{25} (6N1P) for a decrease in the recovery time of multivibrator, which is determined by the time constant of circuit C_3 - grid resistance - cathode of the tube of L_{25} and must not exceed

250 μss. With the aid of switch B_1 (" scale 100 km - 400 km") and relay P_1 is realized switching the pulse duration of multivibrator. In this case to resistance R_5 (" scale") is connected resistance R_4 or R_{99}.

From load R_6 multivibrator positive square pulses enter through capacitor C_6 to the paraphase amplifier, assembled on the right half of tube L_1, and through circuit C_5-R_9 to the amplifier, made on the left half of the tube of the L_{10} of the channel (6N1P) of the formation of the square pulses of illumination. From loads R_{11}, R_{12} paraphase amplifier are removed the negative square pulses of identical amplitude and are supplied to tube L_3 (6X2P), which is common/general/total in the oscillator circuit of the saw-tooth voltage of the channel of horizontal and vertical component scanning/sweep.

Sawtooth generator must develop the linearly changing stress, modulated in amplitude according to the law of sine or cosine of the angle of rotation of azimuth antenna.

The oscillator, assembled on the tube of L_{19} (6N1P) according to

the circuit of parallel feed, supplies by sine voltage 1500 Hz frequency the excitation winding of the noncontact selsyn of BS-2 and the primary winding of the transformer of the carrier frequency Tp_1. The oscillator frequency it determines the duct, which consists of the inductance of the excitation winding of selsyn, the primary winding of transformer Tp_1 and of capacitor C_{32}. For maintaining generation in circuit is applied the positive feedback through the left half of the tube of L_{19}. From plate load R_{66} and R_{68} the right half of the tube of L_{19} the sine voltage through capacitor C_{30} is supplied to the grid of the left half of the tube of L_{19}.

The weak negative communication/connection through the cathode resistance R_{63} improves the form of the generatable sine voltage. Resistance R_{68} regulates the stress level of development/scanning on horizontal and vertical lines. The spline of this resistance is derived on the front/leading panel of unit. From plate load R_{64} the sine voltage through capacitor C_{29} approaches the grid of the right half of the tube of L_{19}.

From output windings g and i of selsyn out of phase by 120° alternating voltages are supplied to the primary winding of 5-3 transformers tp_3 (horizontal component the scanning voltage).

From the third output winding 1 of selsyn the voltage approaches the primary winding of 3-4 transformers Tp_2 (vertical component the scanning voltage). Another end/lead of the winding of selsyn 4 is connected to the midpoint of 4 transformers Tp_3. This start of windings makes it possible to obtain shift/shear on 90° voltages, supplied to transformer. From the secondary windings of transformers are removed the voltages, also out of phase to 90°, proportional: one to sine of the angle of rotation of antenna (horizontal component scanning/sweep), another to the cosine of the angle of rotation of antenna (vertical component scanning/sweep). The obtained voltages through capacitors C_{37} and C_{38} are supplied to the grids of the closed cathode followers, collected on the tube of L_{22} (6N1P).

End of section.

Fig. 96. Failure diagram of phase discriminator.

Cathode followers are intended for the decoupling of the circuits of phase discriminator and selsyn. By a change in the displacement on the grids of cathode followers with the aid of potentiometers R_{82} (" zero-setting, horizon/level. ") and R_{76} (" zero-setting, vert.") in the absence of the voltage of signal, is establish/installed the central position of spot on cathode-ray tube face.

The channels of the formation of the horizontal and vertical components of scanning/sweep are identical (tube of L_{20} and L_{21} - 6N1P); therefore let us examine the diagram of the channel of the formation only of horizontal component scanning/sweep.

From load R_{80} cathode follower the voltage of the signal horizontal component scanning/sweep is supplied to the diagram of the phase discriminator, executed on the tube of L_{21} by the diagram of the switched detector. The scanning voltage is supplied to the anode of the right half of the tube of L_{21} and to the cathode of the left half of the tube of L_{21}. To the grids of tubes, enters the voltage of carrier frequency from windings 7-8 and 9-10 transformers Tp_{1}.

The work of the diagram of phase discriminator is explained by Fig. 96. Before torque/moment t_1, is opened the left half of the tube of L_{21} (see Fig. 95). Condenser/capacitor C_{40} up to torque/moment t_1 is completely discharged. From torque/moment t_1, this tube is opened only at the torque/moments of the agreement of the positive half-wave of the voltage of carrier frequency with the negative half-wave of the voltage horizontal component scanning/sweep. Condenser/capacitor C_{40} for each negative half-wave of voltage will be recharged of up to negative amplitude value on the circuit: the left half of the tube of L_{21} to be recharged friction R_{80}, R_{83}, R_{82}, R_{84} are condenser/capacitor C_{40} - the anode of the left half of the tube of L_{21}.

Up to point in time t_2 (see Fig. 96) condenser/capacitor C_{40} (see Fig. 95) it will be loaded to the maximum value of the signal horizontal component scanning/sweep, potential on the anode of the left half of the tube of L_{21} will become more negative than on cathode, and tube will be shut. But at this time will be discovered the right half of the tube of L_{21}, since potential on its cathode will be more negative than on the anode, because of charge of capacitor C_{40}.

For time t_2-t_3 (cm., Fig. 96) the right half of tube is opened at the torque/moments of the agreement of the positive half-waves of the voltage of carrier frequency with the negative half-waves of the voltage horizontal component scanning/sweep. Up to point in time t_3, condenser/capacitor C_{40} will discharge itself. Beginning from torque/moment t_3 the right half of the tube of L_{21} is opened at the torque/moments of the agreement of the positive half-waves of the voltage of carrier frequency with the positive half-waves of the voltage horizontal component scanning/sweep. Condenser/capacitor C_{40} up to point in time t_4 will be loaded to the maximum positive value. From this time the potential of the anode of the right half of the tube of L_{21} will become negative with respect to cathode and tube it will be shut, but the left half of the tube of L_{21} will be discovered.

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For time t_1-t_5, the left half of the tube of L_{21} is opened at the torque/moments of the agreement positive the half-wave of the voltage of carrier frequency with the positive half-waves of the voltage horizontal component scanning/sweep. Capacitor C_{40} is discharged. At torque/moment t_5, the voltage across capacitor approaches zero and entire process begins to be repeated. Thus from

capacitor C_{40} is remove/taken voltage whose frequency is 1.66 Hz whose amplitude is proportional to the sine of the angle of rotation of azimuth antenna. Displacement on the grids of the tube of L_{21} (see Fig. 95) - automatic, cell/elements - C_{35}, R_{73} and C_{36}, R_{74}.

The obtained sine voltage is filtered by circuit R_{86}, C_{42} and approaches the grid of the cathode follower, assembled on the right half of the tube of L_{23} (6N1P). From load R_{88} this repeater the voltage horizontal component scanning/sweep is supplied to the generator of the L_{11} (6X2P) of saw-tooth voltage. This voltage is switched by switch B_2 (" the checking of the voltages of development/scanning is vertik. - Gorizont. "), who is derived on front/leading panel PPI. Sawtooth generator is the push-pull diode fixatives of level with tubes L_3, L_{11}, connected by bridge circuit. The tube L_3 is common/general/total for the channel of horizontal and vertical components scanning/sweep. Depending on the scale of scanning/sweep with the aid of relay P_1 into one of the diagonals of bridge, is included the circuit: C_{14}-C_{16}-R_{29} or C_{17}-R-$_{30}$.

On the anodes of the left halves of tubes L_3 and of L_{11} through resistance R_{13} given positive voltage from source +180 in, while on the cathodes of the right halves of these tubes through friction R_{14}

- negative voltage from source is 180 in. Therefore so on the absence of square pulses from the paraphase amplifier of tube are completely opened. Since network elements are symmetrical, bridge balanced and at the junction of the cathode of the left half of the tube of L_{11} with the anode of the right half of the tube of L_{11} potential equal to zero.

Coming in to the anodes of the left halves of tubes L_3 and of L_{11} negative square pulses and the positive square pulses on the cathodes of the right halves of tubes L_3 and of L_{11} close them. Capacitors C_{14} and C_{16} or C_{17} charge themselves by the voltage horizontal component scanning/sweep, removed from friction R_{88}. At the termination of the action of the square pulses of tube, they are open/disclosed, capacitors C_{14} and C_{16} or C_{17} rapidly are discharged through the left or right halves of tubes L_3 and of L_{11} and the small friction R_{29}, R_{30} depending on the polarity of sawtooth pulse.

From the cathodes of tubes L_{11}, the sawtooth pulses are supplied to the grid of the input push-pull amplifier, assembled on the left half of the tube of L_{12} (6N1P). The doubled potentiometer R_{60} whose spline is derived on front/leading panel, serves for the equalization of the voltages of the horizontal and vertical components of

scanning/sweep. The doubled potentiometer R_{59} whose spline is derived on front/leading panel, changes the time constant of the circuit of charge, i.e., it changes the amplitudes of the horizontal and vertical components of scanning/sweep.

Push-pull paraphase amplifier is assembled on the tube of L_{12} by diagram with cathode coupling. Sawtooth pulses are amplified by the left half of the tube of L_{12} and from its plate load R_{38} through capacitor C_{23} and friction R_{44} are supplied to the grid of the output tube of L_{15} (6P1P). The removed from the cathode load R_{40}, R_{41} sawtooth pulses are amplified by the right half of the tube of L_{12} and from load R_{39} through capacitor C_{22} and friction R_{48} approach the grid of another output tube of L_{16} (6P1P). The momentum/impulse/pulses, removed from loads R_{38} and R_{39}, are located in antiphase.

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In order that the center of the rotation of scanning/sweep would coincide with the geometric center of screen PPI independent of the scale of scanning/sweep, is necessary the coincidence of the initial

level of saw-tooth voltage with the level of direct-current voltage. For this purpose, in channel are included the fixing cascade/stages on the tubes of L_{13} and L_{14} (6N1P). Cascade/stage L_{13} is two series-connected triodes. Left triode is intended for fixation of level with the positive polarity of sawtooth pulses, and right is intended with negative.

Sawtooth pulses from friction R_{39} will be feed/conducted to the junction of the anode of the right triode and cathode of left triode, and then to the grid of output amplifier. From the cathode load R_{36} the cascade/stage of the illumination, assembled on the right half of the tube of L_{10} (6N1P), the negative square pulses through capacitor C_{24} enter the grids of the tube of L_{13} cut off it. As a result of this, the sawtooth pulses are supplied to the grid of amplifier on the tube of L_{16}.

From the beginning of each period of scanning/sweep, negative square pulse disconnects the grid of the tube of L_{16} and potential on it begins to change in accordance with the entered saw-tooth voltage.

During the action of sawtooth pulses, capacitor C_{22} charges

itself or is discharged depending on the polarity of the sawtooth pulse through the high friction, determined by escapes and the remanent/residual conductivities of the tube of L_{13}. At the termination of the action of sawtooth pulse, the triodes of the fixing cascade/stage trigger themselves and capacitor C_{22} rapidly it is discharged to the value, determined by bias voltage on the grid of the tube of L_{16}.

For a picture centering on horizontal, serves potentiometer R_{58} whose spline is derived on the front/leading panel of block.

Coming in on the grids of tubes L_{15} and of L_{16} the sawtooth pulses of voltage are converted by them into the sawtooth pulses of current. As the plate load of these tubes serve deflection coils L_{3} horizontal component scanning/sweep. Through the midpoint of these coils, is supplied power supply +250 v to the anodes of tubes L_{15} and of L_{16}. Friction R_{44} and R_{48} suppress the possible parasites.

Channel of the formation of the square pulses of illumination. The formed by the multivibrator of duration square pulses are supplied to the grid of the inverter, executed on the left half of

the tube of L_{10} by amplifier circuit during friction. The entering positive square pulse triggers tube, and on its plate load R_{33} is formed the negative square pulse, which past capacitor C_{21} it passes to the grid of the cathode follower, assembled on the right half of the tube of L_{10}. From the output resistance of the cascade/stage of illumination, negative square pulses approach the cathode of cathode-ray tube for the illumination of the foreward stroke of scanning/sweep and to the fixing cascade/stages on tubes L_6, L_7 and L_{13}, L_{14} for their disconnection for a period of the foreward stroke of scanning/sweep.

Scheme of control of cathode-ray tube. For the beam control of this tube of L_{24} (31LM28) are utilized the deflection system, which focuses coil L_2, the magnet of the preliminary centering M_1, the circuit of the brightness control of image, the cascade/stage of focusing, executed on the tube of L_{18} (6N1P), and the cascade/stage of clamping, assembled on the right half of the tube of L_{17} (6X2P).

The focusing of ray/beam is realized by changing the current through coil L_2, which is included in the cathode circuit of the tube of L_{18}. Cathode current is regulated by potentiometer R_{50}, which changes displacement. Potentiometer R_{53} changes bias voltage on the

control electrode of tube, i.e., it changes the intensity of the glow of tube. The cascade/stage, executed on the right half of the tube of L_{17}, is intended for maintaining the initial level of bias on the control electrode of cathode-ray tube.

Fig. 97. Block the PPI: 1 - dial device, 2 - screen PPI; 3 - [illegible] sight; 4 - the potentiometer of centering on vertical; 5 - the potentiometer of centering on horizontal; 6 - the tumbler of switching scales; 7 - the knob/stick of dial device; 8 - the adjustment knob of brightness; 9 - the function selector; 10 - the seat/socket of the switching on of the tube of the illumination of operator's table; 11 - the block of connection operator's fittings; 12 - knob/stick for the extraction of block from the strut of cabinet; 13 - the knob of checking zero of sweep voltages; 14 - the switch of the checking of the voltages of development/scanning; 15 - the backstops of operator's table; 16. measuring meter; 17 - the dial light of measuring meter; 18 - the potentiometer of zero-setting horizontal component sweep; 19 - the potentiometer of zero-setting vertical component scanning/sweep; 20 - the potentiometer of the setting up of the amplitude of sweep voltage; 21 - monitoring jacks; 22 - the trip of operator's table; 23 - the knob/stick of setting up loudness of telephones; 24 - the switch of the operating mode of connected VHF- radio station; 25 - the knob/stick of the focusing of image; 26 - light filter; 27 - the knob/stick of the setting up of sweep amplitude; 28 - the potentiometer of the equalization of sweep voltage.

Constructions. Block PPI (Fig. 97) is structurally executed in the form of volumetric corner chassis/landing gear with inclined and vertical front/leading panels.

Inclined panel has: dial device 1 with the plotted/applied on it azimuth grid through 30°, which consists of the azimuth disk, rotated with the aid of the knob/stick of dial sight 3, and motionless screen 2, potentiometers R_{57} and R_{58} ("centering on vertical line and horizontal"), toggle switch 6 switching scales (100 km - 400 km), potentiometer R_{53} brightness control, switch the "selection of videosignals", seat/socket for the start of the dial light of the stand of operator, potentiometer R_{93} the volume control of telephones, key/wrench B_3 the radio station of RSIU-4 (" transmission-reception/procedure-transmission"), potentiometer R_{50} the focusing of image potentiometer R_{59} the amplitude control of scanning/sweep and potentiometer R60 the administration of scanning/sweep.

On the vertical panel of block, are established/installed block G_3 for a connection the fittings of operator, knob/stick for the extraction of block from the strut of cabinet, knob KN_2 "checking zero" of the voltages of development/scanning, switch B_2 the checking

of the voltages of development/scanning with measuring meter and dial light of his, potentiometers R_{76}, R_{82} zero-setting of the horizontal and vertical components of sweep, potentiometer R_{59} the "Aplituda of sweep voltage", the monitoring jacks of testing the voltage of the vertical and horizontal components of scanning/sweep, the backstops and the trips of the attachment of operator's stand.

The electrical mounting of block is executed in the lower part of the chassis/landing gear. Frcm the back are established/installed knife couplings for the connection of the feeding voltages and supply of the necessarymomentum/impulse/pulses, and also alignment pins.

Fig. 98. Schematic diagram of the block VI.

Key: (1). [illegible]

Power units of display unit.

Display unit is supplied from the unit VI, which issues the stabilized positive DC voltage +250 in (current 180 mA) and the stabilized negative DC voltage 180 in (current 150 mA) and unit wove, salient the stabilized DC voltage +180 in (current 280 mA) and high voltage +5 kV (current 1 mA).

Schematic diagram of the block VI (Fig. 98). Upon the switching on of toggle switch B_3 (" the incandescence of the tubes of indicator") alternating current by voltage 280 v and by frequency 400 Hz through the coupling P_1 (terminal 2, 3), the contacts of toggle switch B_3, the safety device/fuse Pr_2, shunted by friction R_{39} and by the neon tube of NL_2, coupling P_1 (terminal 4, 5) it is supplied to the filament transformers of the units of display unit. Upon the switching on of toggle switch B_4 (" the anode voltage of indicator") alternating voltage is supplied to the anode-filament transformer Tp_2 rectifier - 180 in.

At the output/yield of rectifier - 180 in is included the winding of monitoring relay P_2 whose contacts switch on current by voltage 208 v and by frequency 400 Hz on the primary windings of transformer Tp_1 unit VI and transformer Tp_1 unit it wove, on which were assembled rectifiers +250 v even +180 in. During the appearance of a voltage +180 in, is included monitoring relay P_1. Through the contacts of this relay, the alternating voltage 208 in approaches the primary winding of transformer Tp_2 rectifier +5 kV of unit it wove.

Direct/constant voltage +250 in is remove/taken from the selenium rectifier D_1, assembled by bridge circuit. Voltage is stabilized by the electronic regulator which is executed on tubes L_1, L_2 (6N13S), L_3 (6J4). The tubes L_1 and L_2 are controlling, but tube L_3 - amplifier.

Fig. 99. Unit VI.

Fig. 100. Schematic diagram of the block it wove.

Key: (1). Address. (2). Housing. (3) Hz. (4) mA.

The output voltage of rectifier is regulated by potentiometer R_{16}, which changes direct/constant voltage on the control electrode of amplifier tube. By potentiometer R_{18} is establish/installed the optimum stabilization factor.

Stabilized voltage +250 in is supplied to the contacts of the switch of the measuring instrument of IP_1 and through the safety device/fuse Pr_4, shunted with friction R_{43} with the neon tube of NL_4, the terminal of 9 couplings P_1 for the power supply of the circuits of the units of display unit.

Selenium rectifier D_2 is assembled by bridge circuit. Unidirectional voltage - 180 v from capacitor C_7 is supplied to electronic stabilizer where the tubes L_4, L_5 (6P3S) - controlling, L_6 (6J4) - is amplifier and L_7 (SG-2S) - supporting/reference stabilitron tube in the cathode of amplifier tube. For the power supply of the shielding circuits of control tubes, is assembled separate/individual rectifier D_3 by bridge circuit. Its output voltage is smoothed by filter C_6, R_{24}, C_8. Potentiometer R_{32} serves

for the adjustment of output voltage.

Fig. 101. Unit wove.

By potentiometer R_{34} is regulated stabilization factor. From the output/yield of rectifier, the voltage - 180 v through the safety device/fuse Pr_3 in parallel to which are included friction R_{42} and neon tube NL_3, will be feed/conducted to the grid circuits of display unit.

The construction of unit VI. unit (Fig. 99) is mounted on rectangular chassis/landing gear with front/leading panel. Large parts and tubes are placed above, fine parts and electrical mounting - in the basement of chassis/landing gear. Input and output voltages are supplied through the coupling P_1 knife type.

On front panel are derived toggle switch B_3 (knob/stick 1) the switchings on of the incandescence of tubes PPI, tube LN_1 2 illumination of the scale of control voltmeter, control voltmeter 3, toggle switch B_4 (knob/stick 4) the switching on of the anode voltage PPI, safety device/fuses 6 (Pr_1, Pr_2, Pr_3, Pr_4) in feed circuits, neon tubes 5 (NL_1, NL_2, NL_3, NL_4), that fix blowing, toggle switch B_2 7 switching control voltmeter, toggle switch B_1 8 switching on of the illumination of instrument and plug/silencer of the potentiometers of the adjustment of output voltages +250 v even -180 in. Unit is inserted into cabinet PPI and is fastened with the captive

screw/propellers.

Schematic diagram of the block it wove (Fig. 100). From the selenium rectifiers D_1, D_2, assembled by bridge circuits, is remove/taken direct/constant voltage +180 in. Unidirectional voltage is supplied to the electronic regulator in which the tubes L_1, L_2 (6N'3S) - controlling, L_3 (6J4) - is amplifier, L_4 (SG-4S), L_5 (SG-3S) - stabilitron tubes. From the output/yield of electronic regulator, the voltage +180 in is supplied to instrument IP_1 and through the safety device/fuse, shunted with the neon tube of NL_3 by friction R_{30}, to the terminal of 5 couplings P_1 for the power supply of the anode and shielding circuits of unit PPI.

By potentiometer R_{15} within low limits is regulated the output voltage of rectifier.

The high-voltage rectifier, assembled on rectifiers D_3, D_4, serves for obtaining voltage +5 kV for the power supply of the first accelerator of cathode-ray tube unidirectional voltage it is filtered by circuit C_{10}-C_{11}-R_{23}-C_{12}.

From the output/yield of rectifier, the voltage +5 kV is supplied to output high-voltage coupling P_2 and through the divider/denominator during friction R_{25}, R_{26}, R_{27} to instrument IP_2.

Fig. 102. Cabinet of the supervisory equipment: 1 - unit ANC; 2 - the unit of the inspection of the setting up of azimuth; 4 - adapter; 5, 7 - the units of the rectifiers of supervisory equipment; 6 - the unit of the feed of ANC; 8 - the unit of the inspection of frequency; 9 - the generator of quartz signals; 10 - unit decoder; 11 - the block of the inspection of zero of range.

The construction of unit it wove. Unit (Fig. 101) is assembled on rectangular chassis/landing gear. The mounting of unit is executed from above chassis/landing gear (large parts) and within (fine parts). On the rear wall of chassis/landing gear, are arranged two knife couplings P_1 and P_2.

On the front/leading panel of unit, are instruments 2 (IP_1 and IP_2) with the tubes of 1 illumination of the scales and toggle switch 3 (B_1) the switching on of dial lights, safety device/fuses 5 Pr_1, Pr_2, Pr_3) in feed circuits with neon tubes 4 (NL_1, NL_2, NL_3) the indication of their burn-out. Unit is inserted into cabinet PPI.

Chapter VI.

EQUIPMENT FOR MONITORING [redacted] AZIMUTH AND INSPECTION OF ZERO OF RANGE.

This equipment is intended for the operational inspection of the ranging and azimuth channels of equipment for radio beacon. Functionally it is divided into two channels: the channel of the

inspection of zero of range and the channel of the inspection of the settings up of azimuth which work independently of each other.

The first channel is intended for the inspection of the stability of the signal delay in the ground-based circuit of ranging channel, which determines the reference point of the scale of range finder. the second - for the inspection of the correctness of the setting up of sensor "supporting/reference 36", for the adjustment of this sensor and indication of the presence of reference pulses "35" and "36".

Equipment for inspection consists of:

KVP, arrange/located at a distance 130-140 m of radio beacon and having the receiving antenna of signals (the horn antenna of decimeter range);

the receiving antenna of azimuth signals, which is paraboloid with half-wave dipole;

diplex straight receiver, from output/yield of which the momentum/impulse/pulses on two cables of RK-1 are relayed to radio beacon;

the cabinet of supervisory equipment (Fig. 102) which is placed in the apparatus cabin of radio beacon.

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Fig. 103. Simplified functional diagram of equipment for the inspection of zero of range.

Fig. 104. Block diagram of the inspection of zero of range.

Key: (1). Generator. (2). Ground-based equipment. (3). the circuit of comparison.

Key: (1). Modulator. (2). Antenna. (3). Antenna. (4). Unit. (5). Inquiring signal.

Operating principle of equipment for the inspection of zero of range. Ranging is conducted from conditional zero which is located from true zero for a period, equal to the initial delay in the aircraft measuring circuit. For the compensation for this delay into the circuit of the ground-based channel of ranging, is artificially introduced the signal delay on time, which in sum with all time delays in the process of the passage of signal must be accurately equal to the initial delay in the aircraft measuring circuit. Equipment monitors the stability of this delay in the process of operation.

In the principle of the inspection of the delay in ground-based channel is the principle of comparison of delay time in interval of time, stability which is provided for with quartz.

In generator G_1 (Fig. 103) is created the pair of momentum/impulse/pulses with the stable interval of the aaaa between them, equal to the delay time of the signal in the ground-based circuit of aaaa. These momentum/impulse/pulses directly are supplied to comparison circuit and are transmitted through the circuit whose delay is monitored. The delayed in this circuit momentum/impulse/pulses approach comparison circuit. In this case, if

aaaaaaa that the second momentum/impulse/pulse of generator G_1 coincides with the first momentum/impulse/pulse, passed ground-based circuit, therefore, a delay in the diagram is stable, which confirms the function of the comparison circuit, which switches on tube "the setting up of range accurately".

During the deflection of delay time in ground-based circuit, if aaaaaaaa or aaaaaaaa momentum/impulse/pulses do not coincide and tube "the setting up of range accurately" does not light up. Equipment for the inspection of zero range ensures indication during a change in the delay in limits +0.3 μss.

In equipment for the inspection of zero of range, enter the unit of the generator of the quartz signals (GKS), the receiving antenna of pulse signals, the ranging channel of extension receiver, the pulse channel of the unit of decoder and the unit of the inspection of zero of range (KND). Besides the indicated units and the assemblies of supervisory equipment, in the circuit of inspection work the units of DWP, OZ, DZD, WDA, transmitter P-20D and its antenna.

The delay in ground-based circuit is composed of the delays: in the unit of DWP to the maximum time of the code of inquiring signal, in the unit of DZD, the unit of WDA with the coding of response signal, equal to the maximum time of the code of response signals, and in the diagrams of ranging channel.

Unit GKs (Fig. 104) develops two-pulse send operations with repetition frequency 55 Hz. The stability of the interval between the leading impulse fronts of each pair is determined by crystal oscillator. The interval between momentum/impulse/pulses is changed depending on the selected code of inquiring signal.

The manufactured in the unit of GKS momentum/impulse/pulses, which imitate inquiring, are fed to the inlet of the unit of the decoder of supervisory equipment (DWKA).

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From the output/yield of this unit, the decoded momentum/impulse/pulses approach the inlet of the unit of KND, where

is located comparison circuit.

The interrogation pulses, manufactured in the unit of GKS, are supplied to the inlet of the unit of DWP, where the momentum/impulse/pulses are decoded and are delayed independent of code on the maximum time of the code of interrogation pulses. Momentum/impulse/pulses from the output/yield of the unit of DWP approach the inlet of unit OZ and further to the inlet of the unit of the DZD, which serves for the correction of the delay in ground-based circuit.

From the output/yield of the unit of DZD, the momentum/impulse/pulses are supplied to the inlet of the unit of WDA, where they are ciphered by one of the four codes of response signals. From the output/yield of this unit, the momentum/impulse/pulses approach the starting/launching of the modulator of the transmitter of P-20D. Response signals are emitted by the antenna of the transmitter of P-20D, is accepted by the horn antenna of KVP and are supplied to the inlet of the pulse channel of extension receiver, being delayed in this case in ether/ester for a period 0.43-0.46 μss, which corresponds distance 130-140 m.

From the output/yield of extension receiver, reciprocal momentum/impulse/pulses are relayed on the cable of RK-1 150 m long to the apparatus cabin of radio beacon, being delayed in this case on 0.79 µss, and they are supplied to the inlet of the ranging channel of the unit of From the output/yield of this unit, reciprocal momentum/impulse/pulses approach comparison circuit (into unit KND).

With this method of the checking of a pulse delay in the relay of range finder, is eliminated the checking of delay into hearth and is introduced a supplementary delay in the reciprocal momentum/impulse/pulse (in unit of KND, ether/ester, extension receiver and cable); therefore unit GKS it works under these conditions, that in it are taken into account these delays, and it provides obtaining the quartz interval with duration 183.45 µss.

If the delay in ground-based circuit coincides precisely with the quartz intervals, then to the diagram of the checking of zero of range enter inquiring and reciprocal momentum/impulse/pulses in this time/temporary relation, that the first reciprocal momentum/impulse/pulse synchronizes with the second inquiring, in this case the diagram of the checking of zero of range wear/operates and provides indication "the setting up of range accurately".

If in ground-based circuit the delay changed to one side or the other, then pulse coincidences do not take place and indication "the setting up of range accurately" is not included.

Besides the direct/straight function of the checking of zero of range, equipment provides the checking of the work of the ground-based circuit of ranging channel as a whole. In the diagram of the checking of zero of range, is provided the checking of call signals with the aid of the tube whose ignition indicates their presence.

Operating principle of equipment for the inspection of the setting up of azimuth. This equipment is intended for testing the correctness of delivery of one of the reference pulses "36" at the torque/moment of the passage of the minimum of the emission/radiation of the antenna of the transmitter of the P-200M of the direction in north, and also for the delivery of the signal of the adjustment of sensor "reference pulses "36" in the case of time lag or lead/advance of the delivery of these momentum/impulse/pulses. Furthermore, this

equipment makes it possible to check the presence of reference pulses "35" and "36". In equipment is developed also the momentum/impulse/pulse "Video-transfer," which is supplied on PPI and creates on it brightness mark.

The antenna of the azimuth channel of extension receiver geodetic is establish/installed so that the straight line, drawn from the center of the parabolic azimuth antenna of the transmitter of P-200M, passing through the center of the radio mirror of KVP, is directed at an angle, multiple 10° with respect to true northern direction.

This location of the azimuth antenna of KVP is necessary for testing the correctness of the delivery of the reference pulses "36", one of which must be emitted into the torque/moment of the passage of the middle of failure of the antenna radiation pattern of the transmitter of the P-200M through the direction in north.

Fig. 105. Block diagram of the inspecticn of zero of azimuth.

Key: (1). Antennas. (2). Antenna. (3). Reference pulses "35" and "36". (4). Unit DWKA. (5). Reference pulses "35" and "36". (6). Initial momentum/impulse/pulse. (7). Unit. (8). Azimuth momentum/impulse/pulse. (9). Unit KUA.

The correctness of time of the emission/radiation of reference pulses "36" is checked at the torque/moment of the passage of the middle of failure of the antenna radiation pattern of the transmitter of P200M through the direction to the KVP, which in the particular case can coincide with northern direction. This method of testing is feasible in connection with the fact that the reference pulses "36" are issued through each 10° rotation of this antenna. Consequently, if at the torque/moment of the passage of the middle of failure of the antenna radiation pattern of the transmitter of the P-200M through the direction in KVP is issued reference pulse "36", then at the torque/moment of the passage of the middle of failure of this radiation pattern through the northern direction also will be issued reference pulse "36".

During the work of the channel of the inspection of azimuth, participate transmitter P-200M (Fig. 105), the antenna of the transmitter of P-200M, transmitter the P-20A of reference azimuth signals, the antenna of reference signals, the antenna of the azimuth channel of extension receiver, the antenna of the pulse channel of extension receiver, the extension receiver, which enters the composition KVP, the units of DWKA, of adapter PU) and of the inspection of the setting up of azimuth (KUA).

At the torque/moment of the passage of the antenna radiation pattern of the transmitter of the P-200M through the direction in KVP at the output/yield of the azimuth channel of extension receiver, are separate/liberated the signals of the forms "dual bell" which on cable are relayed to the apparatus cabin of radio beacon and are supplied to the inlet of the unit PU in which of the azimuth signal they are form/shaped the initial and azimuth momentum/impulse/pulses. The initial momentum/impulse/pulse is form/shaped from the leading edge of azimuth signal, and azimuth corresponds to the middle of failure of the antenna radiation pattern of the transmitter of P-200M.

The initial and azimuth momentum/impulse/pulses are supplied to the inlet of the unit of KUA, where with their aid are form/shaped the momentum/impulse/pulses of the right and left zone with the approximately equal to duration. Both momentum/impulse/pulses along two different channels are supplied to the coincidence circuit of the unit of KUA.

Reference pulses "35" and "36" are emitted by the antenna of the

transmitter of P-20A, they are accepted by the horn antenna of KVP and approach the inlet of the pulse channel of extension receiver.

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From the output/yield of this receiver, the coded momentum/impulse/pulses are relayed on cable into the apparatus cabin of radio beacon and approach the inlet of the supporting/reference channel of the unit of DWKA. From the output/yield of the unit of DWKA, the reference pulses "36" are supplied to the inlet of units PU and of KUA. To the inlet of the unit of KUA, are supplied also the reference pulses "35".

Agreement of one of the reference pulses "36" with azimuth momentum/impulse/pulse is record/fixed by the firing of neon tube "accurately", which indicates the correctness of the setting up of sensor "supporting/reference "36". When the setting up of sensor "supporting/reference "36" is produced incorrectly and reference pulse "36" is issued earlier than the azimuth momentum/impulse/pulse, then it coincides with the momentum/impulse/pulse of left zone and in the unit of KUA is fired neon tube "to the left", that indicates the

bias of this sensor against the direction of rotation of the antenna of the transmitter of P-200M. If reference pulses "36" come after azimuth momentum/impulse/pulse, then lights up neon tube "to the right".

The bias of sensor "supporting/reference "36" for the correction of the setting up of azimuth is conducted with the aid of the selsyns one of which is arranged in the unit of KUA, and by the second - in the column of the rotator of the transmitter of P-200M.

In equipment for inspection, is provided the diagram of the inspection of the emission/radiation of reference pulses "35" and "36". The decoded in the unit of DWKA reference pulses "35" and "36" approach the inlet of the unit of KUA and start the multivibrator, in anode circuit of which is included the tube "supporting/reference "35" or "supporting/reference "36". Tubes light up in the presence of the indicated signals in ether/ester.

Control extension point/item.

Control extension point/item is intended for the reception of the ranging and call signals, emitted by the transmitter of P-20D, the reference signals, emitted by the transmitter of P-20A, azimuth signals, emitted by the transmitter of P-200M, with the subsequent relaying of these signals into the apparatus cabin of radio beacon into the cabinet of supervisory equipment.

In composition KVP, they enter:

antenna for the reception of ranging, call and reference signals;

the antenna, consisting of paraboloid and vibrator irradiator, intended for the reception of azimuth signals;

extension receiver.

Functional diagram of extension receiver. Receiver is assembled by the diagram of straight amplification (Fig. 106) and consists of

two independent of each other channels: pulse and azimuth.

Pulse channel is intended for reception and amplification of ranging, call and reference signals to the value, necessary for their relaying into the apparatus cabin of radio beacon.

The accepted by this antenna signals are supplied to the detector input/introduction, the transformed signals of high frequency into the videosignals which go to four-stage video amplifier. The intensive signals approach the cathode follower, which agrees the output resistance of video amplifier with the wave impedance of the cable which is utilized for the relaying of signals into the apparatus cabin of radio beacon.

Azimuth channel is intended for reception and amplification of the signals, emitted by the transmitter of P-200M, and their relaying into the apparatus cabin of radio beacon. The taken signal from the antenna of KVP is supplied to detector input/introduction, and from it - to two-stage amplifier. The intensive signals pass to the cathode follower, which agrees the output resistance of amplifier in the line impedance of the delay which suppresses pulse interferences.

Fig. 106. Functional diagram of extension receiver.

Key: (1). Pulse channel. (2). Detector input/introduction. (3). Amplifier. (4). the [illegible] (5). the [illegible] (6). Detector input/introduction. (7). Two-stage amplifier. (8). Cathode follower. (9). Diagram of interference suppression. (10). Amplifier. (11). Amplifier is inverter. (12). Cathode follower. (13). Azimuth channel. (14). Detector. (15). Cathode follower. (16). Power unit. (17). Output/yield of azimuth channel.

The purified from interferences signal goes to the amplifier of automatic gain control (AGC), and from its output/yield - to cathode follower and inverter-amplifier simultaneously. Cathode follower decreases by-passing detector AGC on two-stage amplifier. From the output/yield of cathode follower, the signal is supplied to the detector AGC, which develops control voltage and supplies it to the first and second amplifier stages.

Inverter-amplifier amplifies the signal before its relaying into the apparatus cabin of radio beacon. For the agreement of the output resistance of amplifier with the wave impedance of the cable on which the signal is relayed into the apparatus cabin of radio beacon, there is a cathode follower.

The power unit provides the cascade/stages of pulse and azimuth channels with the feeding voltages.

Schematic diagram of extension receiver (Fig. 107). Ranging channel (Fig. 107). From the antenna of pulse signal channel, approach the detector loading, which is the cut of coaxial line, along the axis of which consecutively with central vein/strand is

included high-frequency diode D_1. The friction of aaaa is intended for the closing a circuit of the dc current component of diode. Positive signals from the detector through capacitor C_2 approach the control electrode of the first amplifier on tube L_1 (6J1P) and being video amplifier with simple anode correction (L_1, R_6) in the range of high frequencies. Bias to cascade/stage is automatic, because of a voltage drop across friction R_8, by the shunted capacitor C_5.

Negative pulses approach the control electrode of the second amplifier on tube L_2 (6J1P) whose diagram is analogous to the diagram of the first amplifier.

Positive pulses from the friction of plate load R_{13} the second amplifier across capacitor C_{10} go to the control electrode of the third amplifier on tube L_3 (6P1P). Since the incoming on the inlet of this pulse amplifier possess large amplitude, to its grid is supplied negative bias from divider/denominator R_{17}, R_{18} (connected at output/yield rectifier - 150 c), equal approximately to the potential of the closing of tube L_3.

Fig. 107. Schematic diagram of the pulse channel of extension receiver.

Key: (1). To power unit. (2) 1-1 amplifiers. (3). Cathode follower. (4). Range finder to the unit of [illegible] (5). To the power unit of P2-3. (6). Housing. (7). To power unit.

The intensive negative pulses from the friction of plate load R_{21} through capacitor C_{15} approach the fourth amplifier, assembled on tube L_4 (6P1P) with feedback which is created because of a voltage drop across friction R_{27}. Feedback is applied for the expansion of the dynamic range of amplifier.

In the circuit of the control electrode of tube L_4, is included the diode D_1, which restricts the positive overshoots of momentum/impulse/pulses. For a decrease in the distortion of flat/plane pulse apex in anode circuit, is applied the compensating filter, which consists of friction R_{25} and capacitor C_{16}.

From plate load R_{26} the fourth amplifier the positive pulses through capacitor C_{18} are supplied to control electrode of cathode follower on tube L_5 (6P1P). Tube L_5 to the arrival of positive pulse is closed by the negative voltage which is remove/taken from divider/denominator R_{29}, R_{33}. From the cathode load R_{32}, the positive pulses through switch B_1 fall to coupling the "output/yield of pulse channel". From this coupling the momentum/impulse/pulses on cable are supplied to the equipment cabin of radio beacon to the unit of DWKA.

If switch B_1 is located in position "inspection", then on cable is relayed signal from the inlet of azimuth channel. In the value of this signal it is possible to judge the radiated power of the transmitter of P-200M.

Azimuth channel (Fig. 108). The signals, accepted by the azimuth antenna of KVP, are supplied on cable to the detector input/introduction of the azimuth channel which is executed analogously with the detector input/introduction of ranging channel. From detector input/introduction the positive signal of the form of "dual bell" through friction R_{39} and capacitor C_1 approaches the control electrode of amplifier on tube L_1 (6K4P). Bias to control electrode is supplied from divider/denominator R_{14}, R_{16}, the connected at output/yield rectifier - 150 in, through friction R_{15}, R_{12} and R_{13}. From plate load R_2, negative signal is remove/taken on voltage divider R_5, R_6. From friction R_6, the voltage through capacitor C_3 approaches the control electrode of the second stage of the amplifier, assembled on tube L_3 (6K4P) through diagram to the analogous diagram of the first cascade/stage. Bias to the control electrode of this tube is remove/taken from the same divider/denominator R_{14}, R_{16} after friction R_{15}, R_{12} and R_{17}.

Fig. 108. Schematic diagram of the azimuth channel of extension receiver.

Key: (1). Amplifier. (2). Cathode follower. (3). Detector. (4). Amplifier. (5). Cathode follower. (6). Amplifier of inverter. (7). Cathode follower. (8). Detector is inlet. (9). Circuit. (10) in. (11). Housing. (12). To unit.

Negative voltage from load R_{18} the second cascade/stage past capacitor C_8 passes to the cathode follower, assembled on the left half of tube L_4 (6N6S). From load R_{23}, negative signal is supplied to the inlet of the diagram of interference suppression, which is the cascade/stage of agreement, which consists of the delay line in the LZ-1 and diodes D_1, D_2 and D_3. The load of the cascade/stage of agreement is the friction R_{26}. Diode D_4 restricts undershoots. Friction R_{24}, serves for the creation of the direct-current circuit of this diode.

The diagram of interference suppression works as follows. Before the arrival of signal, the diodes D_1, D_2 and D_3 are opened and current it creates a voltage drop across friction R_{26}. Signal on the load of the cascade/stage of agreement can be isolated only in such a case, when everything three diodes are simultaneously closed. At the torque/moment of the arrival of the negative signal whose duration considerably more the delay in the line of LZ-1, simultaneously are cut off everything three diodes and at friction R_{26} appears positive voltage surge.

Pulse interferences, as a rule, have small durations and cannot lock simultaneously three diodes; therefore virtually these

interferences at the output/yield of coincidence circuit do not appear.

The presence of three diodes, connected to the different removal/outlets of delay line, eliminates the passage of "code" pulse interferences, since the probability of the agreement of time intervals is low.

Delay line does not introduce the temporary displacement of signal, since its form is determined by the potential of voltage on the cathode of the diode D_1, which is connected to the cathode follower where a signal delay is equal to zero.

Voltage from the load of the cascade/stage of the agreement across capacitor C_9 goes to the control electrode of the amplifier AGC, from output/yield of which it is supplied to the first and second amplifier stages (L_1, L_3).

The diagram of intensive AGC is applied in view of the fact that the input signal can change over wide limits.

Fig. 109. The schematic diagram of the block of the power supply of extension receiver.

Key: (1). Circuit. (2). Housing. (3) +150 in, 20 mA. (4) in.

The intensive signal is supplied to the control electrode of amplifier AGC, to the half of tube L_5 (6N3P) by the diagram of rheostat negative-feedback amplifier because of a voltage drop across friction R_{29}. From load impedance R_{30}, negative voltage through isolating capacitor C_4 approaches the cathode follower, assembled on the left half of tube L_2 (6N3P). From load R_8 cathode follower the voltage of the same polarity is supplied through capacitor C_5 to detector AGC

detector AGC is assembled on the right half of the tube L_2 which to the arrival of signal is closed by the positive voltage, subject on its cathode from divider/denominator R_{10}, R_{11}, which is included on the output/yield of rectifier +150 in, and by the negative voltage, subject on its anode from divider/denominator R_{14}, R_{16}, which is included at the output/yield of rectifier -150 in. The value of this cutoff voltage is selected by such, that on of input signal level less than 0.2 in tube is closed and the diagram AGC does not work. In this case, the factor of amplification of two-stage amplifier is maximum. With an increase in the input signal higher than level 0.2 in the tube of detector is open/disclosed and capacitor C6 charges itself on the circuit: the earth/ground - C6 charge themselves the right half of the tube of L_2-R_{11}. The constant of the capacitor charging circuit C_6 is selected by such, that it

charges itself up to the amplitude value of signal.

At the termination of the action of signal, capacitor C_6 is discharged on the circuit: C_6 is discharged the earth/ground - R_{14}-R_{15}-C_6. The constant of discharge circuit is selected considerably more than the repetition period of signal.

Capacitor C_7 and friction R_{12} serve as the filter, which decreases the pulsations of voltage AGC. From capacitor C_7, negative voltage AGC is supplied through friction R_{13} and R_{17} to the control electrodes of tubes L_1 and L_3.

As a result of application/use AGC, the output potential of the azimuth channel of extension receiver changes not more than by +-10o/o during a change of the value of input signal in limits 0.2-0.6 in.

The purified from pulse interferences negative signal from amplifier AGC across capacitor C_{11} goes to the control electrode of the inverter-amplifier, Assembled on the right half of the tube of

L_4.

From the anode of inverter-amplifier, the signal through capacitor C_{12} approaches the cathode follower, assembled on the right half L_4. Fromload R_{36} of cathode follower positive signal is supplied to coupling the "output/yield of azimuth channel" and on cable is relayed into the apparatus cabin of radio beacon into unit PU.

Power unit of extension receiver (Fig. 109). The unit provides the delivery of the following stresses: +150 into that which was not stabilized, -150 into that which was stabilized, +150 in, stabilized, 63 into variable.

The nonstabilized stress +150 in develops the rectifier, executed by full-wave diagram on kenotron L_1 '(TsIP). At the output/yield of this rectifier for the smoothing of pulsation is a filter, which consists of throttle/choke Dr_1 and capacitors C_1, C_2.

Stabilized voltage +150 in develops the rectifier, executed also by full-wave diagram on kenotron L_2 (6Q4P). Voltage is remove/taken

from stabilitron tube L_3 (SG1P), connected after ballast resistance R_2 and R_4. Friction R_4 variable, for the adjustment of output voltage.

Stabilized voltage 150 v for the power supply of bias circuits is remove/taken from stabilitron tube L_5 (SG1P), assembled with kenotron L_4 (6Q4P).

Supply voltage on the anodes of the kenotrons of all rectifiers is supplied from one transformer Tp_1. From this same transformer is remove/taken voltage 6.3 v for the power supply of the filament circuits of extension receiver.

Power unit works from the grid/network 208 in, 400 Hz, which will be feed/conducted from radio beacon on special cable to coupling Sh_2 through switch B_1 and the safety device/fuse Pr_1. For the inspection of the soundness of safety device/fuse Pr_1 in parallel to it is included the tube NL_1 with friction R_1.

Extension receiver (Fig. 110) is executed in the form of the

miniature/small unit which is fastened on by antenna to mast. On the front/leading wall of receiver, are arranged the controls and high-frequency couplings for the connection of cables.

End of section.

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Unit of decoder.

Fig. 110. Extension receiver.

Fig. 111. Functional diagram of the unit of DShKA. Key: (1). Ranging channel. (2). Inquiring signal. (3). Call signal. (4). Response signal. (5). Video amplifier. (6). Cathode fol(7). Coincidence stage. (8). Interrogation signal amplifier. (9). Coincidence stage. (10). Coincidence stage. (11). Response signal amplifier. (12). Cathode follower. (13). Delay line. (14). Reference signals "36". (15). Video amplifier. (16). Cathode follower. (17). Coincidence stage. (18). Amplifier. (19). Coincidence stage. (20). Amplifier. (21). Input. (22). Delay line. (23). Azimuth channel.

This unit is intended for deciphering the coded pulse signals, which enter it from the unit of GKS and extension receiver, and for their distribution th nits of KND, PU, KUA.

In the unit of DShKA there are the ranging channel in which are decoded pulse ranging and the call signals by duration 1 μs, and the azimuth channel in which are decoded the reference pulses by duration 6 μss.

Functional diagram (Fig. 111). Ranging channel. From the output/yield of extension receiver, the coded response, call, reference "36" and "35" signals are relayed on cable and together with interrogations are supplied to the cathode follower which will match the wave resistance of cable with the entry impedance of video amplifier.

From the cathode follower coded reciprocal, call and inquiring signal they approach the input of the ranging channel which consists of four cascade/stages of video amplifier, cathode follower, three cascade/stages or agreement and output amplifiers of inquiring and response signals.

The separation of signals is conducted with the aid of the input circuits of ranging channel, the time constant of which is selected so that the reference signals "35" and "36", that have large duration, are differentiated and do not pass into the subsequent cascade/stages of channel, but the range-finders signal, which have lesser duration, pass without distortions.

The intensive with the aid of four cascade/stages signals go further to the cathode follower which will match the output resistance of video amplifier with the line impedance of delay. Delay line together with the cascade/stages of agreement is intended for deciphering range-finders signal.

The decoded inquiring and response signals, intensified preliminarily, and call directly from the output/yield of the cascade/stage of agreement are supplied to the input of the unit of KND.

Azimuth channel consists of two cascade/stages of video amplifier, cathode follower, line of delay, cascade/stages of the agreement of reference signals "36" and "35" and the amplifiers of decoded signals.

From the output/yield of cathode follower the coded reference signals "36" and "35" enter the input of video amplifier. The intensive signals are supplied to the cathode follower, which agrees the output resistance of video amplifier in the line characteristic of delay. The decoded signals through output amplifiers are supplied to unit KUA.

Schematic diagram (Fig. 112). Channel of long-range and call signals. From common connector $_1$ ("input") reciprocal momentum/impulse/pulses through capacitor C_{51} approach the control electrode of the tube of L_{12} (6N1P). On the tube of L_{12}, is assembled cathode follower. To the grid of the right half of this tube through capacitor C_{48}, is supplied the interrogation pulse from divider/denominator R_{95}, R_{94} which is included at the output/yield of the unit of GKS.

The mixed signals from load R_{90} the cathode follower through capacitor C_1 approach the control electrode of the first cascade/stage of the video amplifier, assembled on the left half of tube L_1 (6N1P) through rheostat diagram. Bias voltage is supplied from rectifier - 105 c through divider/denominator R_1, R_3.

From the anode of the first cascade/stage, the negative pulses through capacitor C_4 go to the grid of the second cascade/stage which works on the right half of tube L_1 and is made on rheostat circuit with feedback because of the drop of voltage on resistor/resistance R_4.

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The intensive positive pulse from the plate load of R_8 through capacitor C_5 is supplied to the grid of the third cascade/stage whose diagram is analogous to the diagram of the first.

The intensive negative pulses enter the fourth cascade/stage assembled on tube L_3 (6P1P). This cascade/stage works on tetrode with

automatic displacement because of the drop of voltage on resistor R_{18} which shunted by capacitor C_{10}. The anode of tube L_3 is fed from rectifier +150 v through filter R_{20}, C_9, while screen grid is powered through resistor/resistance R_{21}.

Positive pulses from the anode of the fourth cascade/stage through capacitor C_8 enter the grid of the cathode follower, assembled on the right half of tube L_2. From load R_{13} cathode follower they are supplied to the delay line LZ-1. Delayed signals from output 12B go to the control electrode of the cascade/stage of the agreement, assembled on tube L_5 (6Zh2P), to diodes D_4 and D_5 the coincidence circuit of response signals.

Decoding is done as follows. Diodes D_4 and D_5 in the absence of momentum/impulse/pulses from delay line are opened, since on their anodes given positive voltage through resistor/resistance R_{22} from source +150 V. At the torque/moment of the action of positive pulses from delay line which are supplied to the cathode circuit of diodes and exceed in amplitude voltage on the anodes, diodes they are cut off, on their load of D_{27}, is developed the positive pulse, which across capacitor C_{16} goes to the amplifier of interrogation pulses.

The amplifier of interrogation pulses is assembled on tube L_4 (6Zh1P). As its plate load serves the triple-wound peak transformer Tp_2 whose windings are included so that from the third winding is removed the positive pulse. Diode D_1 does not transmit negative pulses.

Call momentum/impulse/pulses are decoded with the aid of the delay line LZ-1 and cascade/stage of agreement on tube L_5. The premise/impulse of the call momentum/impulse/pulses of those entering on the input of the delay line consists of two momentum/impulse/pulses, applied to the control electrode of the cascade/stage of agreement. To the suppressor grid of this cascade/stage, enter the momentum/impulse/pulses from one of the removal/outlets of delay line depending on code. These removal/outlets are selected so, in order to during the arrival of the first momentum/impulse/pulse on control grid of tube L_5 on the suppressor grid of this tube would arrive the second momentum/impulse/pulse of the coded premise/impulse. With the simultaneous arrival of positive pulses to governing and suppressor grid, the tube triggers itself and in its anode target/purpose is formed negative pulse.

In the absence of momentum/impulse/pulses on grids, the tube is closed by the negative voltage, applied on control electrode from divider/denominator R_{37}, R_{39} and on suppressor grid - from divider/denominator R_{31},R_{33}. Resistor/resistance R_{39} - variable, is intended for the amplitude control of call momentum/impulse/pulses at the output/yield of the cascade/stage of agreement.

Anode load of cascade/stage of agreement is the triple-wound peak transformer Tr_3 which is included so that from its third winding are removed the positive pulses.

Decoding of reciprocal momentum/impulse/pulses it occurs on diodes D_6 and D_7 analogous with deciphering interrogation pulses. The amplifier of reciprocal momentum/impulse/pulses on tube L_6 (6Zh1P) is analogous to the amplifier of interrogation pulses.

Key: (1). Channel of ranging and call signals. (2). Amplifier. (3). Amplifier and cathcde follower. (4). Amplifier. (5). Amplifier of inquiring signals. (6). Coincidence stage of the call signals. (7). Amplifier of response signals. (8). Inquiring signal. (9). Response signal. (10). Call signal. (11). Input F_1. (12). Cathode follower. (13). Coincidence circuit of inquiring signals. (14). Coincidence circuit of response signals. (15). Channel of reference signals.

Fig. 112. The schematic diagram of the block of DShKA. Key: (1). Amplifier of the reference signals and cathode follower. (2). Amplifier of reference signals. (3). Coincidence stage of reference "35". (4). Coincidence stage of reference "36". (5). Amplifier of reference "35" and reference "36". (6). Response interrogation. (7). Reference "35". (8). Reference "36". (9). Target/purpose. (10). Ground. (11). Interrogation. (12). Answer/response. (13). Output/yield. (14). Call. (15). Reference "35" and "36". (16). Codes. (17). Interrgation to DShP. (18). Interrogation to DShP.

Fig. 113. Unit DShKA:

1, 2, 4, 6, 8 - potentiometers of the adjustment of the displacement of the coincidence stages; 3, 7, 9, 10, 11, 13, 14, 16 - control sockets; 5 - the toggle switch of switching on "inquiring to DShKA"; 12 - code switch; 15 - high-frequency coupler.

Channel of azimuth signals. Azimuth reference pulses "35" from extension receiver approach the input of the unit of DShKA. The positive pulses through capacitor C_{27} are supplied to the grid of the first cascade/stage of the video amplifier, assembled on the left half of tube L_7 (6N1P). The diagram and the principle of operation of its and first cascade/stage of the video amplifier of ranging channel are analogous.

From plate load R_{59} this cascade/stage the momentum/impulse/pulse is supplied to the second cascade/stage on tube L_8 (6P1P). The intensive momentum/impulse/pulse enters through the capacitor C_{29} to the grid of cathode follower and further to the delay line LZ-2. The principle of deciphering the reference momentum/impulse/pulses "36" and "35" and of the call momentum/impulse/pulses of ranging channel is analogous.

Momentum/impulse/pulses from delay line approach the input of the cascade/stages of agreement on tubes L_9 (6Zh2P) and L_{10} (6Zh2P). The diagram and the work of the cascade/stages of agreement are analogous to diagram and the work of the cascade/stage of agreement are analogous to diagram and to the work of the cascade/stage of the agreement of call signals. From the anodes of tubes L_9 and ot L_{10},

the decoded momentum/impulse/pulses through capacitors C_{36} and C_{40} are supplied to the amplifiers, assembled on the left and right halves of the tube L_{11} (6N1P). Feedback is realized by resistor/resistances R_{85} and R_{86}.

From the anode resistor/resistances R_{81} and R_{83}, positive supporting/reference pulses "36" and "35" through the capacitors of C_{45} and C_{47} go to the input of the unit of KUA and monitoring jacks.

Constructions. The cell/elements of unit (Fig. 113) are assembled on L-shaped chassis/landing gear, on rear wall of which there are couplings P_1 and P_2. To coupling P_1 are conducted all the feeding voltages of unit, while to coupling P_2 - all pulsing circuits. On the front/leading panel of unit, are arranged the potentiometers of the adjustment of the displacement of the cascade/stages of agreement, the switches of codes and monitoring jacks.

Unit of adapter.

This unit is intended for the formation of the azimuth, initial, starting and video remote momentum/impulse/pulses.

Azimuth momentum/impulse/pulses as duration 160 μss and with amplitude not less than 30 in have a position which corresponds to the middle of failure of azimuth signal (Fig. 114).

Functional diagram (Fig. 115). The channel of the formation of strobe pulse converts azimuth signal into rectangular negative pulses. Channel consists of the amplifier of video pulses, two series-connected amplifier-limiters, detector and multivibrator of formation.

Formation occurs by consecutive amplification and limitation of azimuth signal, as a result of which is isolated one square pulse whose duration is approximately equal to the duration of azimuth signal.

Fig. 114. The diagram, which elucidates the operation of unit PU:

a - azimuth signal; b is the initial momentum/impulse/pulse; c - azimuth momentum/impulse/pulse.

Fig. 115. Functional diagram of unit PU. Key: (1). Channel of the shaping of strobe pulse. (2). Channel of rocking momentum/impulse/pulses. (3). Natal momentum/impulse/pulse into unit KUA. (4). Amplifier-limiter. (5). Amplifier and detector. (6). Multivibrator. (7). Amplifier-limiter. (8). Amplifier and cathode follower. (9). Cascade/stage of addition. (10). Output/yield. (11). Channel of azimuth momentum/impulse/pulses. (12). Input. (13). Shaping stage. (14). Cascade/stage of gating/strobing. (15). Phantastron. (16). Multivibrator. (17). Azimuth momentum/impulse/pulse into unit KUA. (18). Channel of video-remote pulses. (19). Multivibrator. (20). Coincidence stage. (21). Blocking oscillator. (22). Cathode follower.

The signal which comes in from remote receiver will be fed to amplifier and, after amplification, to two amplifier-limiters where is conducted its conversion into square pulses which, for a final formation, are supplied to multivibrator. For a decrease in the by-passing on the multivibrator of the second amplifier-limiter, is placed the detector.

From the output/yield of the channel of formation, negative square pulses enter the channel of azimuth momentum/impulse/pulses and after differentiation into the channel of the initial momentum/impulse/pulses.

From output/yield the channel of formation negative square pulses enter the channel of azimuth momentum/impulse/pulses and after differentiation into the channel of the initial pulses.

The channel of the initial momentum/impulse/pulses consists of two amplifiers, amplifier-limiter and cathode follower. These momentum/impulse/pulses are formed by means of the formation of the leading edges of the differentiated square pulses, which enter the input of channel.

Negative square pulses from the channel of formation approach the first amplifier. The intensive momentum/impulse/pulses for further formation are supplied to the amplifier-limiter, with output/yield of which negative pulses go to the second amplifier and further to cathode follower. Cathode follower will match the output resistance of the second amplifier with the entry impedance of the cascade/stage of addition and the unit of the adjustments of azimuth, to which enter the initial momentum/impulse/pulses.

The channel of azimuth momentum/impulse/pulses is intended for formation and selection of trigger pulses and for the formation of azimuth momentum/impulse/pulses from those which start. The selection of trigger pulses is provided for the purpose of the elimination of the triggering of circuit from the momentum/impulse/pulses, which were being formed from the minor lobes of the antenna radiation pattern of the transmitter P-200M.

The channel of azimuth momentum/impulse/pulses consists of the cascade/stage of the formation of trigger pulses, amplifier,

phantastron and multivibrator. Positive azimuth signal (Ris. 116) it is supplied to the input of the cascade/stage of the formation of trigger pulses.

Fig. 116. The diagram of the formation of the azimuth momentum/impulse/pulse:

a - azimuth signal; b is trigger pulse; c - azimuth momentum/impulse/pulse.

Trigger pulses from the output/yield of the cascade/stage of formation are supplied to the amplifier which is intended for the selection of these momentum/impulse/pulses. Simultaneously to amplifier enters momentum/impulse/pulse with the channel of formation. The obtained as a result of addition momentum/impulse/pulse goes to the starting/launching of the phantastron, which forms the square pulse, the read-out time of which and the duration are highly stable. The momentum/impulse/pulse, obtained at the output/yield of phantastron, after differentiation is supplied to the starting/launching of the multivibrator which form/shapes azimuth momentum/impulse/pulse.

The azimuthal momentum/impulse/pulses approach the cascade/stage of addition and the input of the channel of the isolation of video-remote momentum/impulse/pulses, and also on the input of the unit of the adjustment of azimuth.

Azimuth momentum/impulse/pulses approach the cascade/stage of addition and the input of the channel of the isolation of video-remote momentum/impulse/pulses, and also on the input of the unit of the adjustment of azimuth.

The channel of the isolation of video-remote momentum/impulse/pulses form/shapes the square pulse which is utilized for the orientation of image along azimuth on PPI and for a constant monitoring of work of radio beacon. This channel consists of multivibrator, coincidence stage, blocking oscillator and cathode follower.

Azimuth momentum/impulse/pulse approaches the starting/launching of the multivibrator which form/shapes square pulse by duration of approximately 800 μss. Momentum/impulse/pulse with multivibrator goes to the cascade/stage of agreement, which isolates one momentum/impulse/pulse of call signal. For this, to coincidence circuit simultaneously with the momentum/impulse/pulse of multivibrator are supplied call momentum/impulse/pulses. At the torque/moment of the pulse coincidence of multivibrator with one of the call momentum/impulse/pulses, is isolated one square pulse, which for a further formation is supplied to blocking oscillator. With the output/yield of blocking oscillator the video-remote momentum/impulse/pulse goes to the cathode follower, which matches the output resistance of blocking oscillator with the wave impedance of the cable on which is realized the relaying of video-remote

momentum/impulse/pulse on PPI.

Schematic diagram (Fig. 117). Channel of the formation of the strobe pulse. On the left half of tube L_1 (6N2P) is assembled the amplifier by rheostat diagram, the operating mode of which is selected so that in the absence of azimuth signals this half is found in the closed state. Cutoff voltage is supplied from the divider/denominator, which consists of resistor/resistances R_1, R_3. Resistor R_3 - variable, is intended for the threshold adjustment of function. In the circuit of the grid of the left half of tube L_1 is included the integrating circuit R_{79}, C_{37}, which weakens pulse interferences. The intensive signals from plate load R_4 through capacitor C_2 approach the grid of the right half of the tube L_1, which works as limiter on the maximum of voltage. Displacement to limiter is removed from resistor/resistance R_6 because of cathode current. The limited momentum/impulse/pulses with the anode of the right half of tube L_1 go to the grid of tube L_2 (6N1P). On tube L_2 is assembled amplifier-limiter and detector. Amplifier-limiter (left half of tube) it works in the mode/conditions of grid-circuit clipping on maximum.

The operating mode of tube is selected by such, that to the

torque/moment when entry stress less than zerc, cascade/stage wo:ks as usual amplifier. As soon as grid voltage beccmes positive appears the grid current, which is limited to resistor/resistance R_{34}. As a result of the redistribution of voltage on resistor/resistances R_{34} and the section of tube grid-cathode the grid voltage remains close to zero.

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Bias voltage to the grid of the left half of tube L_2 is removed from divider/denominator R_8, R_{10}, the connected with output/yield rectifier - 105 V.

From the anode of the left half of tube L_2, negative pulses are supplied to the differentiating circuit C_4, R_{12} and further to the cathode or the right half of tube L_2 on which is assembled diode limiter by the diagram of consecutive limitation. Since diode possesses unidirectional conductivity, during the supplying to its cathode of heteropolar momentum/impulse/pulses from the differentiating circuit on its load R_{13} appear the only negative pulses which approach the starting/launching of the multivibrator of

formation on tube L_3 (6N1P).

The shaping multivibrator has the only one stable situation, when the right half of tube L_3 is unlocked by the positive voltage, subject to its grid through resistor/resistance R_{18} from source +250 V.

The pulse duration of multivibrator exceeds the interval between the starting negative pulses. This is necessary in order that the multivibrator on could enter the work from the second trigger pulse. The second trigger pulse is obtained because azimuth signal has a form of "dual bell".

The negative square pulses of formation from the anode of the left half of tube L_3 are supplied to the channels of azimuth and initial momentum/impulse/pulses.

Channel of the initial momentum/impulse/pulses. The rectangular negative pulses, manufactured by the channel of formation, after the passage through the differentiating circuit C_7, R_{10} and the diode D_{10}

approach the grid of tube L_4 (6N1P). On the left half of this tube, is assembled the amplifier which works with automatic displacement because of a voltage drop across resistor/resistance R_{20}.

Positive voltage from resistor/resistance R_{20} through resistor/resistance R_{100} is supplied to diode the D_{10} with the aid of which is limited the positive pulse after differentiation. Diode is cut off by this voltage and triggers itself at that torque/moment when the amplitude of the negative pulses, removed from capacitor C_7, becomes more than cutoff voltage. As a result for the grid of the left half of tube L_4, enters the momentum/impulse/pulse of lesser duration. This momentum/impulse/pulse from load R_{21} the left half of tube L_4 across the capacitor C_9 goes to the grid of the amplifier-limiter, assembled on the right half of tube L_4. Negative displacement is supplied from divider/denominator R_{24}, R_{25} through resistor/resistance R_{23}. Amplifier-limiter works in the mode/conditions of limitation on the minimum. It amplifies momentum/impulse/pulses until absolute value of grid voltage becomes more than the cutoff voltage of tube. Tube is cut off and a further increase in the pulse amplitude does not change operating mode.

Negative to momentum/impulse/pulse from plate load R_{22} are

supplied through the capacitor C_{10} to tube L_5 (6N1P). The temporary situation of momentum/impulse/pulses at the output/yield of this tube corresponds to the leading impulse front of formation.

On tube L_5 are assembled the amplifier and cathode follower. Negative pulses from the anode of tube L_4, through capacitor C_{10} approach the input of the diode limiter, which consists of diode D_1 and resistor/resistance R_{27}. During the supplying of negative pulses, the diode D_1 triggers itself and capacitor C_{10} charges itself on the circuit: R_{22} - +250 C - is internal resistor/resistance of the power source -250 V - R_{27} - D_1 - C_{10} - R_{22}. For a rapid capacitor discharge, is included resistor/resistance R_{26}. Up to the torque/moment of the arrival of the following momentum/impulse/pulse, the capacitor completely is discharged. This is made in order to avoid the displacement of the operating point of the characteristic of diode.

Key: (1). Channel of the shaping of strobe pulse. (2). Channel of the initial momentum/impulse/pulses. (3). Amplifier-limiter. (4). Amplifier and detector. (5). Multivibrator. (6). Amplifier-limiter. (7). Amplifier and cathode follower. (8). Cascade/stage of addition. (9). Circuit. (10). Ground. (11). ~208 V, 400 Hz. (12). +250 V. (13). Triggering threshold. (14). Channel of video-remote pulses. (15). Multivibrator. (16). Coincidence stage. (17). Blocking oscillator. (18). Cathode follower. (19). Ground. (20). Azimuth pulse. (21). Initial pulse. (22). Calling. (23). Reference "36". (24). Coincidence stage bias. (25). Bias check.

Fig. 117. The schematic diagram of the block of adapter.

Key: (1). Channel of azimuth pulses. (2). Cascade/stage of the formation of trigger pulses. (3). Amplifier and cathode follower. (4). Phantastron. (5). Multivibrator. (6). Adjustment of azimuth momentum/impulse/pulse.

end section.

Fig. 118. The simplified circuit of the cascade/stage of the formation of trigger pulse (a) and the curve/graph of the formation of trigger pulse (b). Key: (1). Output/yield.

Negative pulses frcm load R_{27} diode limiter are supplied to the grid of the left half of the tube L_5 on which is assembled the pulse amplifier by rheostat diagram with feedback. The intensive momentum/impulse/pulse from plate load R_{29} across the capacitor S_{11} goes on I cut the right half of the tube L_5 on which is assembled cathode follower. The operating mode of repeater is selected so that about the absence of positive pulses on grid tube would be closed by the negative displacement which comes from voltage divider R_{32}, R_{33} through leakage resistance R_{31}.

Positive pulses frcm load R_{30} cathode follower are supplied to the input of the cascade/stage of addition cn tube L_6 (6N1P) and unit KUA.

Channel of azimuth pulses. The cascade/stage of the formation of trigger pulses form/shapes the pulses, which are isolated at the level 0.5 amplitudes of the azimuth signals which approach its input. As a result of this, the read-out time of azimuth pulses does not depend on the amplitude of azimuth signals, which is important with the fcrmation of azimuth momentum/impulse/pulses.

The cascade/stage of formation is assembled on the tube of L_{11} (Fig. 118). Its work entails the following. Azimuth positive signal in the form of "dual bell" through capacitor S_{13}, resistor/resistance R_{63} and the winding of transformer Tp_4 is supplied to the right half of the tube of L_{11} (6N1P). From the cathode load R_{72}, the azimuth signal through the capacitor S_{22} approaches divider/denominator R_{65}, R_{66}. In this case, the capacitor S_{24} charges itself on the circuit: +?50 C - R_{62} - the internal lamp resistance of L_{11} is C_{22} - R_{65} - D_6 - C_{24} - - 250 in.

The left half of the tube of L_{11} is closed by the positive voltage, subject to its cathode from resistor/resistance R_{65}.

During decay in the azimuth voltage signal, on the anode of diode D_6 becomes less than voltage on its cathode. As a result the diode is cut off and charge of capacitor C_{24} ceases. In time interval t_1 - t_2, the voltage across capacitor C_{24} ceases. In time interval t_1 - t_2, the voltage across capacitor C_{24} remains constant/invariable.

At torque/momentof time t_2, when voltage on the cathode of the left half of the tube of L_{11} becomes equal to voltage across

capacitor C_{24}, tube triggers itself and capacitor S_{24} is discharged on value: capacitor S_{24} - the anode resistance of L_{11} - winding 1 -2 transformers Tp_4 - resistor R_{65} - resistor/resistance R_{66} is the earth/ground - capacitor S_{24}. In this case, during winding 1 - 2, appears the drop of voltage with the polarity, indicated in Fig. 118.

In secondary winding 4 - 3 transformers $T\rho_4$ this drop transmits so that produces the closing of the right half of the tube of L_{11}, and in anode circuit is obtainedthe positive triggering momentum/impulse/pulse.

Fig. 119. Pulse diagram, which elucidates the work of the cascade/stage of gating/strobing. Key: (1). Grid. (2). Cathode. (3). Anode. (4). Trigger pulse.

The torque/moment of the function cf the diagram of formation is determined by the relationship/ratio of the arms of divider/denominator R_{65}, R_{66}, which during adjustment is selected so that function would occur at the level 0.5 amplitudes of azimuth signal.

Diode D_{14} serves for the prevention of the parasites in the secondary winding of transformer Tp_4, which appear with the termination of momentum/impulse/pulse. The circuit, which consists of resistor/resistance R_{63} and capacitor C_{25}, decreases the pulse interferences at the input of the cascade/stage of formation. From plate load the starting positive pulse is supplied to the cascade/stage of gating/strobing.

The cascade/stage of strobing eliminates the launch opportunity of phantastron by the false trigger pulses which are issued by the diagram of formation during its function from the second momentum/impulse/pulse of azimuth signal, and also by the momentum/impulse/pulses, which are obtained from the minor lobes, the radiation pattern of azimuthal antenna. The trigger pulses through the capacitor S_{30} (see Fig. 117) from the anode of the cascade/stage of shaping, approach the grid of the cascade/stage of the

gating/strobing, assembled on the left half of the tube of L_{12}. To the arrival of the positive trigger pulse on the grid of tube and negative square pulses from the cascade/stage of formation to cathode, the tube is closed. Cutoff voltage is created during the cathode resistor/resistance R_{85} because of the current of divider/denominator R_{69}, D_{12} and R_{85}, of the connected at output/yield rectifier +250 in.

Diode D_{12} increases the resistor/resistance of the circuit of D_{12}, D_{85} for the negative pulses, applied to its input, which decreases by-passing this circuit on the multivibrator of formation.

In the absence of negative pulse on resistor/resistance R_{85}, is created the drop of voltage because of the passage of current along the circuit: +250 C - is resistor/resistance R_{69} - diode D_{12} - resistor/resistance R_{85} is 250 in. By this voltage the left half of the tube of L_{12} is closed. In the torque/moment of the arrival of negative pulse from the output/yield of the cascade/stage of the formation of strobe pulse the diode D_{12} is cut off and positive voltage on the cathode of the left half of the tube of L_{12}, it decreases.

During the joint action of the starting pulse and pulse of formation, the tube of the cascade/stage of gating/strobing triggers itself and on the anode it is isolated the starting pulse (Fig. 119).

The negative starting pulses impultsy through capacitor C_{28} are supplied to the anode of the tube of L_{13} 6J2P, see Fig. 117). On the right half of the tube of L_{12} and the tube of L_{13}, is assembled the phantastron by diagram with cathode follower and cathode coupling. Phantastron has one stable position conclusion/derivation from which is conducted by the supply of negative pulse on the anode of the tube of the L_{13} through the diode D_9.

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Phantastron form/shapes the square pulse, the repetition frequency of which and the duration of highly stable. For providing this stability in the circuit of control electrode, is applied the resistance of the type of MLT (R_{83}).

The rectangular pulses, form/shaped by phantastron, approach differential circuit S_{33}, R_{89}. After differentiation the momentum/impulse/pulse, obtained from the trailing edge of pulse of phantastron, starts the multivibrator which develops azimuth momentum/impulse/pulses. The torque/moment of the starting/launching of multivibrator can be regulated, by changing voltage on the anode of the tube of L_{13} with the aid of potentiometer R_{93} (" the establishment of azimuth momentum/impulse/pulse"). In this case, is changed the pulse duration, generated by phantastron. By changing the time of the starting/launching of the multivibrator of L_{14} (6N1P), it is possible to change the temporary situation of azimuth momentum/impulse/pulse and to realize its initial installation on the middle of failure of azimuth signal. Multivibrator form/shapes azimuth momentum/impulse/pulses by duration 160 μs.

multivibrator is assembled on the tube of L_{14} by diagram with cathode coupling it works in the waiting mode/conditions. Its starting/launching is realized by supply to the anode of the left half of the tube of the L_{14} of the negative pulse through the diode D_{13}, which limits positive pulses. Rectangular positive pulses with the anode of the right half of the tube of L_{14} go across the

capacitor S_{35} to the input of unit PU and of the cascade/stage of addition.

For the visual test of azimuth pulse with the aid of oscillograph intended monitoring jack G_8 (azimuth momentum/impulse/pulse").

The channel of the video marginal pulses form/shapes them from azimuth, which are supplied on PPI for the mark of the location of KVP.

Azimuth pulses from the multivibrator of azimuth pulses through capacitor S_{15} diode D_8 approach the grid of tube L_7 (6N1P) the multivibrator of the formation of azimuth momentum/impulse/pulses.

Multivibrator is assembled by diagram with cathode coupling and positive grid. It works in the waiting mode/conditions. The starting/launching of multivibrator is realized by supply of positive pulse on the control electrode of the left half of tube L_7. Positive pulse is obtained after differentiation (circuit S_{15}, D_8, R_{42}) of

azimuth momentum/impulse/pulse.

Multivibrator form/shapes azimuth momentum/impulse/pulse by duration 800 μss. The duration of this momentum/impulse/pulse can be changed by impedance matching R_{46}. The duration of azimuth momentum/impulse/pulse increases, because call pulses delay relative to reference pulses "36" for a period of approximately 400 μss, and are consequent, they delay relative to azimuth momentum/impulse/pulse on this time.

For the isolation only of one pulse of call in each turn of the antenna of the transmitter of P-200M, the duration of azimuth momentum/impulse/pulse is expanded to the value, which exceeds temporary displacement between call and supporting/reference "36" pulses.

Positive pulses from the anode of load R_{44}, the right half of tube L_7 through the capacitor S_{17} are supplied to the cascade/stage of agreement, which isolates one of the call momentum/impulse/pulses, that coincides with azimuth. Coincidence circuit is assembled on semiconductor diodes D_2 and D_3. To this diagram enter azimuth

momentum/impulse/pulses from multivibrator L_7 and call.

Coincidence circuit form/shapes momentum/impulse/pulses only during the supplying to its input of the pulses, the total amplitude during agreement of which is sufficient for the triggering of the diode D_4 on which is assembled the limiter for the elimination of the passage of pulse interferences to the input of blocking oscillator. Pulse with the output/yield of the diagram of coincidence goes to divider/denominator R_{48}, R_{50}, and with it to the diode DYa, closed by the positive voltage which it is given to its cathode through resistor/resistances R_{51}, R_{52} and R_{101}.

Fig. 120. Unit PU:

1, 14 - high-frequency couplings; 2, 3, 6, 7, 9, 10, 11, 12, 13 - monitoring jacks; 4, 5, 8, 15 - the potentiometers of adjustment.

The value of cutoff voltage on diode D_4 can be regulated by resistor/resistance R_{52}. In this case, changes the value of voltage at the output/yield of limiter. Resistor/resistance R_{101} deboosts on its output/yield. Momentum/impulse/pulses from load R_{52} the limiter across the capacitor S_{19} go to the starting/launching of blocking oscillator.

Blocking oscillator form/shapes the pulses, issued by coincidence circuit. It is assembled on the right half of tube L_8 (6N1P). On the left half of this tube, is assembled the buffer amplifier, which decreases the effect of blocking oscillator on coincidence circuit. The left half of tube is closed by negative displacement, by subject to the grid through resistor/resistances R_{53} from divider/denominator R_{54}, R_{56}.

Positive pulses by duration 1 μs are remove/taken from the third winding of transformer Tp_2 and after the capacitor S_{20} are supplied to cathode follower.

Cathode follower is assembled on tube L_9 (6N1P). For a decrease in the output resistor/resistance of the repeater of of half the

tubes are included parallelly. The momentum/impulse/pulses, removed from load R_{58} cathode follower, are video marginal. Through cable they approach PPI.

The cascade/stage of addition is intended for a visual test on the oscilloscope face of the output signals of unit PU, for the initial installation of azimuth pulses, and also for the control/checking of the accuracy of the agreement of azimuth and reference "36" momentum/impulse/pulses. To the input of cascade/stage, are supplied the initial, azimuth and supporting/reference "36" pulses.

The cascade/stage of addition is assembled on tube L_6 and is cathode follower. To the grid of the left half of tube L_6 through capacitor C_{12}, is supplied azimuth pulse while to the grid of the right half of tube L_6 through resistor/resistances R_{37}, R_{39}. R_{40} are reference "36", azimuth and initial momentum/impulse/pulses. By impedance matching R_{37}, R_{39}, R_{40} is establish/installed the convenient for observation on oscillograph amplitude of each of the momentum/impulse/pulses.

Diode D_7 limits the undershoots, which appear at the grid of tube L_6 during the supplying of the controlled/inspected momentum/impulse/pulses. The output/yield of the cascade/stage of addition is derived on control nest "mixer" on the front/leading panel of unit PU.

Constructions. Unit is carried out on standard L-shaped chassis/landing gear (Fig. 120). On the rear wall of chassis/landing gear, are arranged knife couplings P_1 and P_2. To coupling P_1, are conducted the feeding voltages of unit, while to coupling P_2 - the pulse circuits, which go to the units of KUA and DWKA. On front/leading panel are placed the sockets to which are connected the cables from extension receiver, the cable, which goes on PPI, and also potentiometers and sockets for the control/checking of signals.

Fig. 121. Functional diagram of the unit of KUA.

Key: (1). μs. (2). μs. (3). Channel of the left zone. (4). Initial momentum/impulse/pulse. (5). Multivibrator of the formation of strobe. (6). Coincidence circuit. (7). First multivibrator. (8). Cascade/stage of accumulation. (9). Second multivibrator. (10). To the left. (11). Azimuth momentum/impulse/pulse. (12). It is accurate. (13). Supporting/reference "35" and "36". (14). Bell. (15). Supporting/reference "36". (16). Cathode follower. (17). Cascade/stage of agreement. (18). Multivibrator. (19). Multivibrator. (20). the generator of current. (21). Chanel of right zone. (22). Multivibrator for formation of strobe. (23). Coincidence circuit. (24). First multivibrator. (25). Cascade/stage of of accumulation. (26). Second multivibrator. (27). Azimuthal pulse. (28). Channel of samocontrolya. (29). Oscillator. (30). Multivibrator. (31). Multivibrator. (32). Multivibrator. (33). Multivibrator. (35). Supporting/reference "36". (36). Initial is pulse.

Unit of the inspection of the installation of azimuth.

This unit monitors the correctness of setting of sensor "supporting/reference "36" and the emission/radiation of reference signals" 36" and "35".

As the basis of the method of control is placed the method of the agreement of reference signals "36" with the following momentum/impulse/pulses:

with azimuth which enters from the output/yield of the azimuth channel or unit PU and corresponds on time to the middle of the signal of the form of "dual bell" in the case of the correct setting up of sensor "supporting/reference "36";

with the momentum/impulse/pulse of left zone which is developed in the unit of KUA with the aid of the initial momentum/impulse/pulse of unit PU, if the setting up of sensor "supporting/reference "36" is biased/beaten to the side, opposite to the direction of rotation of the antenna of the transmitter of P-200M;

with the momentum/impulse/pulse of left zone which is developed in the unit of KUA with the aid of azimuth momentum/impulse/pulse, if the setting up of sensor "supporting/reference "36" is biased/beaten to the side of the direction of rotation of the antenna of the transmitter of P-200<.

The position display of sensor "supporting/reference "36" is realized with the aid of three neon tubes with designations "accurately", "to the left" and "to the right".

Functional diagram (Fig. 121). The channel of left zone is intended for control and obtaining the information about the displacement of sensor "supporting/reference "36" to the side, opposite to the direction of rotation of the antenna of the transmitter of P-200M. This channel consists of the multivibrator of the formation of the gate/strobe of left zone, cascade/stages of agreement and accumulation, multivibrators of the impulse shaping of left zone and indicating neon lamp "to the left".

To the input of channel, they enter the initial and azimuth momentum/impulse/pulses, and from the multivibrator of the formation of gate/strobe, is remove/taken positive pulse and is supplied to coincidence circuit.

If sensor "supporting/reference "36" is displaced to the side, opposite to the direction of rotation of the antenna of the transmitter of P-200M, then in the cascade/stage of the agreement of left zone is developed the positive pulse (Fig. 122), which starts the first multivibrator of the impulse shaping of left zone.

Fig. 122. The pulse diagrams, which elucidate the work of the diagram of control the work of the diagram of the inspection of the setting up of the azimuth:

a - the initial momentum/impulse/pulse; b is strobe zones; c and d are reference pulses "36"; e - the output/yield of the cascade/stage of the agreement of left zone; f - the output/yield of the multivibrator of the impulse shaping of left zone; g - the cascade/stage of accumulation; h - the anode.

This multivibrator develops the positive pulses which are supplied to the cascade/stage of accumulation, which is intended for a protection from random pulse interference and works so that approximately through 4 s the charge, accumulated by cascade/stage, becomes sufficient for the triggering of the second multivibrator of shaping of the pulses of left zone.

The second multivibrator develops pulses with the duration, sufficient for the connection/inclusion of tube "to the left", that signals about the displacement of sensor "supporting/reference "36". In addition to of light signaling, is provided and sonic, realized with the aid of the current generator, relay and electric bell.

The channel of the right zone is intended for an inspection and an indication of the displacement of sensor "supporting/reference "36" to the side of the direction of the rotation of the antenna of the transmitter of P-200M. This channel consists of the multivibrator of the formation of the gate/strobe of the right zone, cascade/stages of agreement and accumulation, two multivibrators of the impulse shaping of the right zone and indicating neon lamp "to the right". To the input of channel, are supplied azimuth momentum/impulse/pulses, while on the cascade/stage of agreement - "supporting/reference "36".

The work of channel is analogous to the work of the channel of the impulse shaping of left zone. During the displacement of sensor "supporting/reference "36" to the side of the direction of rotation of the antenna of the transmitter of P-200M lights up the tube "to the right" and is included bell.

The channel of the fine adjustment of azimuth monitors and indicates the position of sensor "supporting/reference "36". It consists of the cathode follower of reference pulses "36", the cascade/stage of agreement, multivibrator of inspection the bullet of azimuth. To the input of channel, is supplied azimuth momentum/impulse/pulse from unit PU while on the cascade/stage of agreement - reference pulses "36".

If sensor "supporting/reference "36" is established/installed accurately or the error of adjustment is located in margins, then one of the reference pulses "36" coincides in time with azimuth momentum/impulse/pulse and at the output/yield of the cascade/stage of agreement is form/shaped the momentum/impulse/pulse, which starts the multivibrator of the control of zero of azimuth "accurately".

In the unit of KUA, besides the inspection of the correctness of the setting up of sensor "supporting/reference "36", is checked the presence of the emission/radiation of the reference signals "36" and "35" which enter from the unit of DWKA. The starting/launching of multivibrator is conducted either from reference pulses "36" or from reference pulses "35" depending on the position of the switch "supporting/reference "35" - "supporting/reference "36", which simultaneously changes over neon indicator lights "supporting/reference "36" and "supporting/reference "35". The connection/inclusion of these tubes signals about the presence of these signals.

The channel of self-control checks the work of the unit of KUA. For this, in channel are imitated the initial, azimuth and reference "36" momentum/impulse/pulses.

Key: (1). the multivioratcr of the gate/strobe of left zone. (2). Cascade/stage cf coincidence (left zone). (3). Multivibrator of left zone. (4). Cascade/stage of accumulation. (5). Multivibrator of left zone. (6). Duration of the strobe cf left zone. (7). Cathode follower. (8). Cascade/stage of coincidence (right zone). (9). Multivibrator of the right zone.

Fig. 123. The schematic diagram of the block of KUA.

Key: (1). Multivibrator of the gate/strobe of the right zone. (2). Cascade/stage of agreement (zero of azimuth). (3). Multivibrator supporting/reference "35" and "36". (4). Supporting/reference. (5). Circuit. (6). [illegible] (7). [Illegible] (8). [Illegible] (9). Displacement of coincidence circuit of zero azimuth. (10). Channel of self-control. (11). Oscillator 1.6 Hz. (12). Multivibrator. (13). Multivibrator of azimuth momentum/impulse/pulses. (14). Operation. (15). Self-control.

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Fig. 124. Simplified diagram of delay-line multivibrator.

The oscillator of channel develops saw-tooth momentum/impulse/pulses with repetition frequency 1.6 Hz which are utilized for the starting/launching of the multivibrator of impulse shaping with the repetition frequency 1.6 Hz and of the multivibrator of the formation of the initial momentum/impulse/pulses. Positive pulses from the output/yield of the first multivibrator to the after differentiation are supplied to the starting/launching of the multivibrator of the formation of azimuth pulses. The second multivibrator form/shapes the initial momentum/impulse/pulses by duration 8 μs, and also starts the multivibrator of the formation of reference pulses "36".

The formed initial, azimuth and reference "36" momentum/impulse/pulses approach the input of the channels of the unit of KUA during the setting up of switch "work - self-control" into the position "self-control" which makes it possible to check the work of this unit in the absence of the signals of radio beacon.

Schematic diagram (Fig. 123). Channel of left zone. The initial momentum/impulse/pulse from unit PU equipment/device is supplied to the grid of tube L_1 (6N1P) through the circuit of differentiation C_1, R_1 and of D_{17}. Diode D_{17} is intended for the limitation of negative

pulse after differentiation. On tube L_1, is assembled the multivibrator of shaping of the gate/strobe of left zone by the diagram of which waits multivibrator shaping of the gate/strobe of left zone by the diagram of the waiting multivibrator with positive grid and with cathode coupling. The starting/launching of diagram is realized by a positive pulse of differentiation.

In stable more smoothly NII [99sp03 - Scientific Research Institute] the right half of tube L_1 (Fig. 124) is unlocked, since on its grid given positive voltage from of anode power supply +250 v through resistors R_5 and R_8. The value of these resistor/resistances many times is greater the resistor/resistance of interval/gap grid - the cathode of the open right half of tube L_1. Therefore almost whole voltage of the anode power supply of aaaa it falls during resistor/resistances R_5 and R_8, so that voltage between grid and cathode of the right half of tube L_1 almost is equal to zero. The anode current of the right half of tube creates a voltage drop across resistor/resistance R_2 locking the left half of tube L_1. In this case, the capacitor S_3 charges itself of up to the voltage, equal to a voltage difference of aaaa - UR_2.

After the admission of the positive trigger pulse, the left half

of tube L_1 is opened slightly and negative impulse from its plate load through the capacitor S_3 transmits to the grid of the right half of tube. The anode current of this half of tube and a voltage drop across cathode resistor/resistance R_2 decrease, which contributes to an increase in the anode current etc. As a result of the avalanche-like process of a reduction in current of tube L_1, the left half of tube L_1 is triggered, and the right half is cut off. From this point on, it begins capacitor discharge S_3 on the circuit: C_3 is a left half of tube L_1 - resistor/resistance R_2 is housing - the internal resistor/resistance of the source of power - resistor/resistance R_5 and R_8 - C_3. A voltage drop across resistor/resistance R_8, created by the current of the discharge of capacitor C_3, has a polarity indicated in Fig. 124, and its value after the tilting/reversal of diagram is determined from the condition that voltage across capacitor instantly is not changed. Therefore to resistor R_8, additionally transmits entire negative drop of voltagefrom plate load P_3 the discovered left half of tube L_1.

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As a result the voltage on the grid of the right half of tube L_1 exceeds the voltage of the anode feed of aaaa the as a result of

which of what grid voltage of this half of tube will be negative relative to housing despite the fact that through resistor/resistances R_5 and R_8 it is connected to +250 in, and the right half of tube L_1 is cut off.

With capacitor discharge S_3, the current of discharge decreases, therefore, the voltage on resistor/resistance R_8 falls, and the voltage between grid and cathode of the right half of tube L_1 grow/rises. when it achieves the value of triggering, tube is open/disclosed, will appear current and voltage on resistor/resistance R_2. Negative voltage on the grid of the left half of tube L_1 will increase, and the current through it decreases. This produces an increase in the potential of the anode of the right half of tube and grid of left half, which leads to the time of ripening of the anode current through the right half of tube etc. Occurs new avalanche-like the process which returns diagram to the initially stable position: the left half of tube L_1 is closed, and right is opened.

The pulse duration of multivibrator is determined by the time constant of circuit R_5, R_8, C_3, aaaa and R_2, which considerably exceeds the pulse duration of left zone.

For the artificial limitation of the pulse duration of left zone to the grid circuit of multivibrator, is supplied positive azimuth pulse, which produces the tilting/reversal of multivibrator into the torque/moment of the arrival of azimuth pulse.

The azimuth pulse through the diode D_{15} and capacitors C_3, C_4 triggers the right half of tube earlier than capacitor C_3 will discharge itself to the potential of the closing of tube. Therefore the pulse duration of the multivibrator of left zone is equal to the time interval between the leading edges of the initial anl azimuth momentum/impulse/pulses.

variable resistance R_8 makes it possible to select this duration of the pulse of left zone in order to ensure the stop of multivibrator with azimuth pulse as in mode/conditions "work", so k in mode/conditions self-control".

The cascade/stage of the agreement of the channel of left zone

is carried out on semiconductor diodes D_1 (see Fig. 123) and D_2. Output pulses from divider/denominator R_{11}, R_{10} approach the diode D_3, which is intended for the elimination of the passage of pulse interferences for the grid of multivibrator on tube L_2 (6N1P). To input stage enter the momentum/impulse/pulses from the multivibrator of left zone and reference pulses "36".

In the case of the misadjustment of sensor "reference "36" reference pulses "36" coincide with the momentum/impulse/pulse of the channel of left zone and pulse amplitude is sufficient for the opening/triggering of diode D_3. Because of this on load R_{111}, will appear the momentum/impulse/pulse, which through the capacitor S_6 is supplied to the starting/launching of the first multivibrator of the impulse shaping of left zone (L_2). With the adjustment of the value of resistor/resistance R_{111} they change the value of cutoff voltage on diode D_3, which produces change in the output potential of diode. Resistor/resistance R_{112} deboosts on the output/yield of diode D_2.

The first multivibrator of the impulse shaping of left zone is carried out by the diagram of the waiting multivibrator with positive grid and cathod coupling. To the control electrode of this multivibrator, positive pulses from the cascade/stage of agreement

enter after differentiation by the circuit, which consists of the resistor/resistance of R_{13}, capacitor S_6 and diode D_4.

Positive pulses from the right half of tube L_2 through the capacitor S_8 are supplied to the anode of tube L_9 (6N1P) on which is assembled the cascade/stage of accumulation, intended for so that random short-term pulses we could not cause false indication.

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Positive pulses from the first multivibrator approach the anode of the left half of tube L_3 (6X2II) and charge capacitor S_9. The latter has this capacitance that through time of approximately 4 s the charge, accumulated on it, will be sufficient for the triggering of the second multivibrator of the impulse shaping of left zone. Resistor/resistance R_{18} serves for the closing a circuit of the dc current component of tube L_3. From the cascade/stage of accumulation, positive voltage through resistor/resistance R_{20} enter to the second multivibrator.

The second multivibrator of shaping cf the pulses of left zone is assembled on tube L_4 ('HYP) by the diagram of the waiting multivibrator. The starting/launching of multivibrator is realized by supply to the control electrode of the left half of tube L_4 positive pulse from the diagram of accumulation. Tube triggers itself, voltage on its anode falls and neon the tube of NL_1 "to the left", connected in the anode circuit of the left half of tube L_4, it is fired.

Positive pulses from the anode resistor/resistance of the right half of tube L_4, simultaneously switch on neon tube NL_1 and through resistor/resistance R_{53} are supplied to the control electrode of tube L_8 (6N1P). On the left half of tube L_8, is closed by the negative voltage, subject to its grid from divider/dencminator R_{54}, R_{51}, the connected on output/yield rectifier - 105 in. Positive pulses from the right anode of the second multivibrator through divider/denominator R_{53}, R_{52} and R_{51} approach the grid of tube L_8. Tube is open/disclosed. Relay P_1 is included and its contacts they close the feed circuit of bell, it toggle switch V_1 is located in position "sound signal".

Channel of the right zone. The Operation and the destination of the channel of the right zone are analogous to work and the destination of the channel of left zone. The multivibrator of the

gate/strobe of the right zone (tube L_9) develops the momentum/impulse/pulses of the right zone by duration 6 μss.

Multivibrator works on the scheme of the waiting multivibrator with cathode coupling and is triggered by the momentum/impulse/pulse, which corresponds to the trailing edge of azimuth momentum/impulse/pulse, after differentiation by its circuit of S_{20}, R_{40}. Multivibrator develops the positive impulse which through the capacitor S_{22} approaches the cascade/stage of the agreement of the right zone.

The Cascade of the agreement of the right zone is carried out on diodes D_5, D_6, diode D_7 - limiting. To the input of the cascade/stage of the agreement through the capacitor S_{22}, are supplied the positive pulses of the right zone, also, through the capacitor S_{14} - reference pulses "36".

If sensor "supporting/reference 36" is displaced so that the reference pulses "36" coincide with the pulses of the right zone, in the cascade of agreement, is developed the positive pulse which enters through the capacitor S_{15} on the starting/launching of the

first multivibrator of the impulse shaping of the right zone.

This multivibrator on tube L_6 (6N1P) form/shapes the momentum/impulse/pulses, developed in the cascade/stage of agreement. The work of cascade/stage is analogous to the work of multivibrator on tube L_2.

In the case of the misadjustment of sensor "supporting/reference "36" in the cascade/stage of the agreement of the right zone are developed the signals, which subsequently provide the indication of the displacement of sensor. The momentum/impulse/pulses, developed by multivibrator on tube L_6, through the capacitor S_{17} enters to the diagrams of accumulation (right half of tube L_3). This diagram is analogous to the diagram of accumulation on left the half of tube L_3.

Positive voltage from the capacitor of S_{10} is supplied to the starting/launching of the second multivibrator of the impulse shaping of the right zone on tube L_7, is identical to the second multivibrator of the impulse shaping of left zone.

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Tube NL_2 "Viravo", is connected into the anode circuit of this multivibrator, signals about the misadjustment of sensor "supporting/reference "36". From the anode of the second multivibrator, positive momentum/impulse/pulses through resistor/resistance R_{50} approach current generator on the right half of tube L_8, in cathode circuit of which is included the winding of relay P_1 sound communication.

The channel of the fine adjustment of azimuth is intended for a control/checking and an indication the correctness of the setting up of sensor "supporting/reference "36".

The decoded reference pulses "36" from the block of the DWKA through the condenser/capacitor S_{12} are supplied to the grid of the cathode follower which is assembled on tube L_5 (6N1P). From cathode loads R_{30} reference pulses "36" through the condenser/capacitor S_{24} approach the cascade/stage of agreement.

cascade/stage of agreement is assembled on diodes D_8 and D_9. Diode D_{10} - clipping circuit. To the input of cascade/stage of coincidence through the capacitor S_{23}, enter the azimuth momentum/impulse/pulses, manufactured in block PU, and through the condenser/capacitor S_{24} - reference pulses "36".

during the correct setting up of sensor "supporting/reference "36" during resistor/resistance R_{64} is isolated the positive impulse, which through the diode D_{10} and the capacitor S_{25} triggers the

multivibrator of the fine adjustment of azimuth.

This multivibrator is assembled on the tube of L_{10} (6N1P) by the diagram of the waiting multivibrator with cathode coupling and is intended for an impulse shaping, obtained in the cascade/stage of agreement. The starting/launching of multivibrator is conducted by the positive pulse, which enters on the grid of the left half of the tube of L_{10} after differentiation of the momentum/impulse/pulse of the cascade/stage of agreement by the circuit of S_{25}, R_{69}, D_{18}. In the anode circuit of multivibrator, is included neon tube the NL_3 "accurately" which is fired during the function of multivibrator, signalling about the correct position of sensor "supporting/reference "36".

The multivibrator of the control/checking of reference pulses "35" and "36" is assembled on the tube of L_{11} (6N1P) by the diagram of the waiting multivibrator with cathode coupling. The starting/launching of this multivibrator is realized by the reference pulses "35" or "36", which are supplied to the control electrode of the tube of the L_{11} through the toggle switch V_3. Simultaneously toggle switch V_3 connects the neon tubes of NL_4 and Nl_5 to the anode circuit of the tube of the L_{11} whose ignition testifies to the

presence of reference pulses "35" or "36".

The channel of self-control is intended for checking the capacity of the liagram of the inspection of the adjustment of azimuth.

The voltage generator of saw-tooth form develops oscillation/vibrations 1.6 Hz frequency and is intended for the starting/launching of the multivibrator of signal conditioning with repetition frequency 1.6 Hz, which corresponds to the antenna scan rate of the transmitter of P-200M. Generator is assembled on tube L_1 (TGY). At the torque/moment of the switching on of circuit, the tube is closed by negative displacement from voltage separators R_{81}, R_{82}.

Capacitor S_{30} charges itself on the circuit: +250 C - R_{83} - S_{30} - 250 in. When voltage across capacitor and anode of tube reaches the stress level of ignition, tube L_{12} is open/disclosed and capacitor quickly is discharged on the circuit: S_{30} - the anode resistance of L_{12} - S_{30}. Capacitor discharge duration until tube L_{12} again is shut due to a decrease in the voltage on its anode. Capacitor S_{30} again charges itself. The time constant of the circuit of S_{30}, R_{83} is

fitted so that the oscillation frequency is approximately 1.6 Hz.

The negative voltage of the saw-tooth form through the capacitor S_{31} and the diode D_{12} is supplied to the starting/launching of the multivibrator which is assembled on the tube of L_{13} (5N1P) by the diagram of the waiting multivibrator with cathode by communication/connection. This multivibrator form/shapes positive pulses by duration 8 μs by repetition frequency 1.6 Hz which are supplied to the starting/launching of the multivibrator of the formation of azimuth momentum/impulse/pulses and on the multivibrator of the formation of the initial momentum/impulse/pulses. The latter is assembled on the tube of L_{14} (6N1P) by the diagram of the waiting multivibrator with cathode coupling.

Fig. 125. Block the KUA:

1.2.4.5.6 - indicator lights; 3 - the toggle switch of switching the inspection of reference signals; 7, 8, 19, 20 - to the potentiometer of adjustment; 9, 11, 12, 13, 15, 16, 18 - controls sockets. - the knob/stick of the adjustment of agreement; 14 - the switch of operating mode; 17 - the toggle switch of the start of sound communication.

Its starting/launching is realized by supply to the anode of the tube of negative pulses from the generator of saw-tooth voltage through the capacitor S_{33}.

To pulse from the plate load of the right half of the tube of L_{14} is supplied to the circuit of differentiation R_{90}, of S_{34} and D_{11}. The leading edge of the differentiated momentum/impulse/pulse is utilized as the initial momentum/impulse/pulse which through the switch V_2 ("work - self-control") it approaches the input of the diagram of the inspection of the adjustment of azimuth. The differentiated momentum/impulse/pulse from the anode load of the left half of the tube of L_{14} after repeated differentiation by its circuit of S_{38}, R_{106} goes to the starting/launching of the multivibrator of the formation of reference pulses "36".

In the grid circuit of this multivibrator included variable resistance R_{96} (" Adjust. agreement"), smoothly changing pulse duration and the starting time of multivibrator on the tube of L_{15} (6N1P). By regulating resistor/resistance R_{96}, it is possible to change the interval between the initial pulse and the reference pulse "36".

Multivibrator on tube L_{15} is intended for the formation of positive pulses by duration of approximately 180 μss. It is carried out by the diagram of the waiting multivibrator with cathode coupling. The starting/launching of multivibrator is realized by means of supply to the anode of the tube of the positive pulses, obtained as a result of differentiation by the circuit of S_{37}, R_{102} the momentum/impulse/pulses of multivibrator on the tube of L_{13} and corresponding with respect to time to the trailing edge of these momentum/impulse/pulses. The positive pulses through the capacitor S_{36} and the switch V_2 are supplied to block KUA.

Multivibrator on the tube of L_{16} is intended for the formation of the positive pulses which after differentiation are utilized as reference pulses "36". It is carried out by the diagram of the waiting multivibrator with cathode coupling. Its starting/launching is realized by supply to the control electrode of momentum/impulse/pulse from multivibrator on the tube of L_{14}. The positive pulses through the differentiating circuit S_{40}, R_{105}, D_{14} and through the switch V_2 approach the diagram of the inspection of the adjustment of azimuth.

Construction (Fig. 125). Network elements are assembled on U-shaped chassis/landing gear, on rear wall of which are arranged two couplings. To coupling Sh_1, are conducted all the feeding voltages of block, while to coupling Sh_2 - all input and output pulses. Within block is arranged the filament transformer Tp_1. On front/leading panel are placed the neon tubes of the position display of sensor Reference "36" and the presence of reference pulses "35" and "36", switch "shork - Samokontrol'", the potentiometers of adjustment and socket for the inspection of signals with the aid of oscillograph.

Fig. 126. Schematic diagram of the unit of the adjustment of azimuth.

Key: (1). Circuit. (2). Housing. (3). Hz.

Unit of the adjustment of azimuth.

This unit is placed in the cabinet of supervisory equipment and is intended for the setting up of the carriage of sensors at the position, which corresponds to electrical zero of azimuth, and for the adjustment of zero of azimuth.

The fundamental cell/elements of unit are selsyn-sensor and ionizing transformer (Fig. 126). A selsyn transmitter have two windings which are connected with the windings of the receiving synchro, arrange/located into the column of the drive of azimuth antenna. The axis of the rotor of receiving synchro with the aid of reducer and actuating screw is mechanically connected with the carriage of sensors.

Upon the start of toggle switch V_1, the current with voltage 208 v and frequency 400 Hz through the coupling the P_1. of terminal 2 and 3 is supplied to transformer Tp_1 which steps down the voltage to 110 in. Neon tube NL_1 signals about the start of voltage. The setting up of sensors is conducted with the help of knob/stick "zero-setting of azimuth", derivel on the front/leading panel of unit.

On front/leading panel of unit are arranged the tubes of LN_1 "manual" and the LN_2 "automatic machine", which signal about the operating mode of the drive of the rotation of azimuth antenna, and toggle switch V_2 "extension inspection" for an application of voltage on KVP.

Unit of the generator of the quartz signals.

This unit develops premise/impulses with repetition frequency 55 hz. each of which it consists of two pairs of momentum/impulse/pulses. The interval between the leading edges of each pair of momentum/impulse/pulses changes depending on the selected code. Unit consists of the generator of the quartz signals with the frequency dividers, encoder, diagram of self-control.

Functional diagram (Fig. 127). The generator of the quartz signals with frequency dividers and encoder are intended for the formation of the coded paired pulses at intervals between them (by

those determined by the repetition frequency, close to the repetition frequency of SZD.

The channel of the generator of the quartz signals and encoder consists of the following cascade/stages:

the master oscillator, which generates sinusoidal oscillation/vibrations at crystal frequency;

the blocking oscillator, intended for the frequency division of the oscillations of the master oscillator in relation 1:3;

the blocking oscillator, intended for the frequency division of oscillations in relation 1:5;

the nonsynchronous multivibrator, which creates strobe pulse;

the cascade/stage of the isolation of paired pulses;

the cascade/stage of the formation of paired pulses;

the cascade/stage of amplification and formation of the coded samples. nosylok.

Fig. 127. Functional diagram of the unit of GKS.

Key: (1). Master oscillator. (2). Frequency divider 1:3. (3). To Multivibrator. (4). Forming cascade/stage. (5). Coder with the rule of delay. (6). Cascade/stage of the formation of paired pulses. (7). Cascade/stage of the isolation of reference pulses. (8). Interrogation pulse. (9). Interrogation pulse. (10). Amplifier. (11). Channel of self-control. (12). Multivibrator. (13). Multivibrator. (14). Forming cascade/stage. (15). Reciprocal pulse.

Sinusoidal oscillations appear in the master oscillator and are supplied to the frequency dividers, which develop pulsed signals. the repetition frequency of which less than the frequency of the master oscillator 15 times. The time interval between them is very stable is equal to the delay in the ground-based circuit of the range finder channel of radio beacon.

Momentum/impulse/pulses from the output/yield of the second frequency divider are fed to the cascade/stage of the isolation of pairs of pulses. At the same time to this cascade/stage, enter the momentum/impulse/pulses from the multivibrator, which creates the strobe pulses with repetition frequency 55 Hz. As a result at the output/yield of cascade/stage, is form/shaped the pair of pulses with the interval between them, equal to 183.45 μss. Repetition frequency of these pairs 55 Hz.

This repetition frequency is selected as close to the repetition frequency of inquiring signals from airplane transmitter; therefore the inspection of ground-based delay was conducted in the mode/conditions, close to worker.

paired pulses are supplied to the cascade/stage of formation and further to the encoder, at output/yield of which are obtained two pairs of pulses. The interval between the first momentum/impulse/pulses of each pair is equal to 183.45 μss, while the interval between the first and second momentum/impulse/pulses of each the vapors corresponds to one of the four codes. Switching codes is conducted with the aid of switch "inquiring codes". The obtained coded momentum/impulse/pulses are supplied to the units of DWKA and KND.

The channel of self-control is intended for the functional check of the ranging channel of supervisory equipment without the participation of ground-based equipment for the ranging channel of radio beacon. It consists of the amplifier of interrogation pulses, two delay multivibrators in the interrogation momentum/impulse/pulses, cascade/stage of formation.

For checking the correctness of the range-zero calibration on

the diagram of the inspection of zero of range, are supplied two momentum/impulse/pulse: inquiring and the answering, delayed with respect to inquiring in the ground-based circuit of ranging channel for a period of aaaa. In the case of the equality of the delay in the ground-based circuit of time of aaaa, is fired the bulb "accurately". Therefore in order to check unit efficiencies in the mode/conditions of self-control, necessary to have two momentum/impulse/pulse with the stable interval of aaaa.

These momentum/impulse/pulses are obtained thus. Interrogation pulses from the unit of GKS are supplied to unit LWKA, where they are decoded and enter simultaneously into unit Kyd, also, to the amplifier of the interrogation pulses of the channel of self control. Amplified interrogation pulses are fed to the actuation of the first delay multivibrator in these signals.

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Momentum/impulse/pulses are differentiated, and the momentum/impulse/pulse, which corresponds to the trailing edge of pulse of multivibrator, it goes to the starting/launching of the second multivibrator.

The momentum/impulse/pulse, manufactured by the second multivibrator, is differentiated. The momentum/impulse/pulse, which corresponds to the trailing edge of pulse of multivibrator, is supplied to the cascade/stage of shaping and the input of the unit of KND.

Thus output signal is shift/sheared relative to input for a period, equal to the pulse duration of two multivibrators, i.e., for a period of aaaa. By changing the starting time of the second multivibrator, it is possible to check the working capacity of the unit of KND but to the firing of tube "accurately".

The schematic diagram of the block of the generator of the quartz signals (Fig. 128). The master oscillator is assembled on tube L_1 (6N1P). Equivalent oscillator circuit can be brought to inductive Hartley oscillator circuit. Between anode and cathode of tube L_1, is included duct L_1, C_3 which is tuned to a frequency of aaaaaaaa; therefore its equivalent resistance has inductive character, while between the cathode and the grid, is included quartz, equivalent

resistance of which has inductive character. Between the grid and the anode tube is included the capacitor S_1.

Voltage is remove/taken from resistor/resistance R_2, connected in the cathode circuit of generator, and is supplied to the grid of the left half of tube L_2 (6N1P) on which is assembled the buffer amplifier, which decreases the effect of the master oscillator of the work of blocking oscillator. The plate load of buffer amplifier is the primary winding of peak transformer Tp_1, with the help of which the intensive sine voltage approaches the starting/launching of blocking oscillator (right half of tube L_2). Blocking oscillator works in the mode/conditions of frequency division with a coefficient of division of 1:3. For the target/purpose of an increase in the stability of the frequency scaling factor, the blocking oscillator is assembled by diagram with the duct of collision excitation L_2, S_8, connected in the cathode circuit of tube L_2.

The period of the oscillations of the duct of collision excitation is selected three times large the voltage cycle of starting/launching. Resistor/resistances R_8 and R_9, the connected in grid circuit of the right half of tube L_2, are intended for the adjustment of the coefficient of division. The Control of this

coefficient is realized on the oscillograph signal to which is remove/taken from the third winding of transformer Tp_1 after the capacitor S_{12} and the socket G_2. Simultaneously voltage from the third winding of transformer Tp_1 through the capacitor S_{10} is supplied to the second frequency divider on tube L_3 (6N1P).

On the left half of tube L_3, is assembled the buffer amplifier which to the arrival of trigger pulse is closed by the negative voltage, subject on grid from rectifier - 105 in. Blocking oscillator is assembled on the right half of tube L_3 and works in the mode/conditions of frequency division in relation 1:5.

Output pulses with interval 183.45 μss from the third winding of peak transformer Tp_2 through the capacitor S_{15} enter the cascade/stage of the isolation of paired pulses and through the capacitor S_{16} on socket G_3 for the checking of the frequency scaling factor with the aid of oscillograph. The adjustment of the coefficient of division is conducted with the aid of resistor/resistances R_{13} and R_{14}, connected in the grid circuit of blocking oscillator.

Multivibrator 55 Hz is assembled on tube L_4 (6N1P) by the diagram of asymmetrical multivibrator with positive grid and works in auto-oscillating mode/conditions. In the cathode circuit of the left half of tube L_4, is included resistor/resistance R_{16}, which corrects the leading edge strobe momentum/impulse/pulse. The output pulses of different polarity have different duration with identical plate loads and tubes.

Fig. 128. Schematic diagram of GKS unit.

Key: (1). Driving oscillator. (2). Divider/denominator. (3). Divider. (4). Cascadeof formation. (5). Multivibrator the cascade/stage of the isolation of paired pulses. (6). Paired pulses. (7). Encoder. (8). [illegible]

The time constant of the circuit of S_{18}, R_{19} is higher the time constant of the circuit of C_{17}, R_{15}. As a result the positive pulse, removed from the plate load of the right half of tube L_4, has a duration 500 μss. This momentum/impulse/pulse through the coupling capacitor of S_{20} is supplied to the suppressor grid of the cascade/stage of the isolation of paired momentum/impulse/pulses.

the cascade/stage of the isolation of paired pulses is intended for the isolation of paired pulses with the interval of the aaaa which is determined GKS by frequency dividers.
Momentum/impulse/pulses from the second frequency divider and from multivibrator 55 Hz approach cutoff tube L_5 (6J2P). Negative voltage from divider/denominator R_{23}, R_{24} through resistor/resistance R_{20} is given to suppressor grid, and through R_{22} - to the control electrode of tube L_5.

Tube L_5 is opened in the case of simultaneous arrival to its first and third grids of positive pulses with the amplitude, greater than cutoff voltage. In this case the trigger pulse is supplied to blocking oscillator on the left half of tube L_6 (6N1P).

Blocking oscillator form/shapes the momentum/impulse/pulse which is supplied to the line of delay. The starting/launching of blocking oscillator is conducted by the negative pulse, removed from the plate load of the cascade/stage of the isolation of paired pulses.

Blocking oscillator is started by each first momentum/impulse/pulse from the incoming pair of momentum/impulse/pulses with the interval of aaaa; therefore at its output/yield are obtained the formed paired positive pulses with repetition frequency 55 Hz. In the cathode of blocking oscillator, is included the delay line of the LZ-1, which codes interrogation pulses in accordance with four codes of SZD.

Forming blocking oscillator. The coded inquiring positive pulses approach the forming blocking oscillator on the left half of tube L_7 (6N1P). To the arrival of this momentum/impulse/pulse, the right half of tube L_7 is closed by the negative voltage which is supplied from divider/denominator R_{70}, R_{44} through resistor/resistance R_{45} and the winding of transformer Tp_4. The pulse duration, form/shaped by this blocking oscillator, is determined by the line for which are used the cells 9B - 10B and 9B - 11B delay line, 73-1.

In the extended position of the toggle switch of aaaa (" modes. GSS-15A") blocking-generator form/shapes the momentum/impulse/pulses which are utilized for modulation of the generator of standard signals GSS-15A during checking receiver sensitivity NPU.

the diagram of the unit of GKS.

Momentum/impulse/pulses from the winding of transformer Tp_4 are supplied to the terminal of 11 couplings P_2 and enter the units of DWKA and DWP.

The decoded interrogation pulses from the unit of the decoder through the lemma of 10 couplings P_2 and capacitor S_{31} approach the control electrode of tube L_8 (6J1P). On tube L_8, is assembled the amplifier of interrogation pulses by rheostat diagram. Displacement to tube is supplied from source - 105 v through divider/denominator R_{55}, R_{56}. The intensive interrogation pulses across the capacitor S_{33} go to the anode of the left half of tube L_9 (6N1P).

On tube L_9, is assembled the first delay multivibrator in the interrogation pulses by the diagram of the waiting multivibrator in positive grid, intended for the production of positive pulse by duration T. Positive voltage is remove/taken from divider/denominator R_{52}, R_{58}, R_{57}, the connected with output/yield rectifier +250 V.

The duration of output pulse can be regulated with the aid of resistor/resistances R_{60} the "range-zero calibration smoothly" and R_{61} "the range-zero calibration roughly".

The second delay multivibrator in the interrogation pulses is assembled on the tube of L_{10} (6N1P) by the diagram, analogous preceding/previous. Its starting/launching is realized by the negative pulse, formed from the positive pulse, removed from the first multivibrator after differentiation by circuit S_{36}. R_{64}. The trigger pulse through the capacitor S_{38} is supplied to the grid of the right half of the tube of L_{10}.

The negative pulses, removed from the anode of the left half of the tube of L_{10}, approach the differentiating circuit S_{43}, R_{67}. The positive pulses obtained after differentiation and which corresponds to the trailing edge of pulse of the second multivibrator, is supplied to the grid of the right half L_{4}. The obtained momentum/impulse/pulse is shifted relative to inquiring signal by time equal T, which can be changed within small limits with the aid of resistor/resistances R_{60} and R_{61}.

Subsequently the pules go to cascade/stage formations. representing by themselves the amplifier, as plate load of which serves the pulse

transformer Tp_5.

Fig. 129. Unit the kgs:

1 - the potentiometer of the tuning of frequency division; 2, 6 - control sockets; 3 - high-frequency couplings; 4 - the knob/stick of the setting up of range; 5 - switches of codes and operating modes.

two windings of transformer are connected in series for the purpose of obtaining large amplification factor. Output voltage is remove/taken from the third winding. Amplifier works with automatic displacement because of the drop of voltage on resistor/resistance R_{48}, shunted by the capacitor of S_{41}.

Construction (Fig. 129). To rear knife coupling P_1, are conducted everything value the feeds of unit, while to coupling P_2 - all pulsing circuits, which go to the units of decoders and KND. On the front/leading panel are located the potentiometers of the tuning of the frequency scaling factor, the switches of codes, potentiometer, monitoring jacks.

Unit of the checking of zero of range.

This unit monitors the delay time of the signal in the ground-based circuit of ranging channel, determining the accuracy of ranging.

Functional diagram (Fig. 130). For the checking of the delay in

the unit of KND, it is conducted the comparison of the stabilized by quartz time interval with a signal delay in ground-based circuit. In this case, is compared in the cascade/stage of agreement the second momentum/impulse/pulse from the premise/impulse of inquiring signal with the first momentum/impulse/pulse of the premise/impulse reciprocal.

Inquiring signals are supplied to the amplifier, which develops the negative pulses which approach the starting/launching of the first blocking oscillator for obtaining the positive pulses, applied to the cascade/stage of agreement.

Response signals are supplied to corresponding amplifier for amplification and peakings. In amplifier are developed the negative pulses, which start the second blocking oscillator. From the output/yield of the second blocking oscillator, are remove/taken the positive pulses, which approach the cascade/stage of agreement, which isolates negative pulse only into the torque/moment of the agreement of the output pulses of the first and second blocking oscillators. After simultaneous admission of positive signals to the cascade/stage of agreement at its output/yield, appear the negative momentum/impulse/pulses, which go to the starting/launching of the

third blocking-generator.

Positive pulses from the output/yield of the third blocking oscillator by duration 0.2 μss approach the cathode follower, which decreases the effect output of circuits blocking oscillator on the input circuits of multivibrator.

Positive pulses from the cathode follower through the switch which has two position: "tuning work", is supplied to the starting/launching of multivibrator "the setting up of range accurately" if switch it is located in position "tuning".

Fig. 130. Functional diagram of the unit of KND.

Key: (1). Interrogation. (2). Amplifier. (3). 1st blocking generator. (4). Cascade/stage of coincidence. (5). 3rd blocking oscillators. (6). Shaper. (7). Answer. (8). Amplifier. (9). 2-1 blocking oscillators. (10). multivibrator of indication. (11). Cascade/stage of accumulation. (12). Call. (13). Multivibrator of the indication of call signals.

During the setting up of switch into the postition polzheniye of "work" the positive pulses from the output/yield of cathode follower approach the starting/launching of the waiting multivibrator which form/shapes momentum/impulse/pulses by duration 7-9 μss, which ensure normal operation diagrams of accumulation.

Momentum/impulse/pulses from the output/yield of the waiting multivibrator are supplied to the diagram of accumulation, which is intended for obtaining the stable indication of zero of range. Positive pulses from the output/yield of the diagram of accumulation approach the starting/launching of the multivibrator "the setting up of range accurately", which is intended for an indication with the aid of the neon tube "accurately" of the pulse coincidence of the first and second blocking oscillators.

Besides the indication of the stability of the delay, in the unit of KND is conducted the indication of the presence of the call signals, which come in from the unit of DWP, with the aid of the multivibrator, into anode circuit of which is included the neon tube "of call".

Schematic diagram (Fig. 131). Inquiring positive signals from the terminal of 10 couplings P_2 through the capacitor S_1 are supplied to the grid of the left half of tube L_1 (6N3P). On the left half of tube L_1, is assembled the amplifier of interrogation pulses. In the absence of interrogation pulses, the left half of tube L_1 is closed by the negative voltage which is remove/taken from divider/denominator R_2, R_3. During the supplying of positive pulses on grid, the left half of tube triggers itself from the plate load as which serves the primary winding of peak transformer Tp_1 are remove/taken the negative pulses which approach the starting/launching of blocking oscillator. Blocking oscillator is assembled on the right half of tube L_1 and works in the waiting mode/conditions. In the initial state the right half of tube is closed by the negative displacement which is remove/taken from divider/denominator R_7, R_8.

During the supplying to the anode of negative pulse from the output of the amplifier of inquiring signals, the blocking oscillator develops the positive pulse which is remove/taken from the third winding of transformer Tp_1 and after the capacitor S_5 is supplied to the control electrode of tube L_3 (6J2P). Diode D_1 limits undershoots.

Response signals from the terminal of 12 couplings P_2 through the switch V_1 in position "work" approach the grid of the left half of tube L_2 (6N3P) on which is assembled the amplifier of response signals. In the absence of response signals, the left half of tube L_2 is closed by the negative displacement on grid, removed from divider/denominator R_{10}, R_{11}. During the supplying to the grid of positive response signals, the left half of tube triggers itself and from plate load negative pulses they approach the starting/launching of blocking oscillator on the right half of tube L_2.

Fig. 131. The schematic diagram of the block of KND.

Key: (1). [illegible]. (2). Coincidence circuit. (3). 3rd blocking oscillator. (4). Shaper. (5). [illegible]. (6). Multivibrator for adjusting range of point. (7). Circuit. (8). Housing. (9). [illegible] (10). Sensitivity. (11). 2nd blocking oscillator. (12). Multivibrator "of call". (13). Work. (14). Tuning. (15). Interrogation. (16). Answer. (17). Self control. (18). Call. (19). Self-control. (20). Work. (21). Call.

In the initial state the right half of tube L_2 is closed by the negative displacement, removed from divider/denominator R_{15}, R_{16}. During the supplying to the anode of negative pulse from the output of the amplifier of response signals, the blocking oscillator issues the positive pulse which through the capacitor S_{11} approaches the suppressor grid of the cascade/stage of agreement.

The cascade/stage of agreement issues negative pulse during the joint action of inquiring and response signals. Cascade/stage is assembled on the tube L_3 which in the initial state is closed by the negative displacement, removed from divider/denominator R_{18}, R_{19} to control electrode and from divider/denominator R_{23}, R_{24} to shielding. Tube triggers itself only during the agreement of pulse edges or with their shift/shear on value not more than 0.2 μs. With the opening/triggering of tube in its anode circuit, is developed the negative pulse which through the capacitor S_{14} approaches monitoring jack G_2, and through the capacitor S_{15} - to the anode of the third blocking oscillator.

The third blocking oscillator is assembled on the left half of tube L_4 (6N3P). Into starting position this half of the tube of is closed by the negative displacement, removed from divider/denominator

R_{45}, R_{28}. Resistor/resistance R_{45} - unbelted, and, by changing its value, it is possible to regulate the threshold of the function of the diagram of checking.

This blocking oscillator is started by the supply of negative pulse from the cascade/stage of agreement into anode circuit. Output pulse is remove/taken from the third winding of the pulse transformer Tp_3 and is fed with the right half of the tube L_4, which is included by diode.

Fig. 132. Unit the KND:

1 - indicator lights; 2 - the toggle switches of the start of call signal and work; 3 - the potentiometer of the regulation of sensitivity; 4 - monitoring jacks.

From load R_{32} detector voltage through the capacitor S_{19} enters the delay-line multivibrator and through the capacitor S_8 - on the diagram of accumulation.

The waiting multivibrator, is executed on tube L_5 (5M1P) is intended for further signal conditioning. The Triggering of multivibrator is realized by supply of momentum/impulse/pulse on its anode. Momentum/impulse/pulses from the right anode of the tube of multivibrator are supplied to the cascade/stage of accumulation, which prevents the random functions of multivibrator.

The cascade/stage of accumulation is assembled on the right half of tube L_7 (6N3P), where the capacitor of accumulation - S_{25}. Accumulation occurs on the capacitor of S_{25} in such a case, when to the grid of cascade/stage comes not less than 30-40 momentum/impulse/pulses with repetition frequency 55 Hz. At the torque/moment when comes positive pulse, tube L_7 is open/disclosed and capacitor S_{25} charges itself. Charge duration to that torque/moment until voltage across capacitor becomes greater than cutoff voltage, subject to the grid of the left half of tube L_8.

On tube L_8 (6N1P) is assembled the multivibrator "precise range-zero calibration". In mode/conditions "tuning" the starting/launching of multivibrator is realized by supply to its anode of momentum/impulse/pulses from the output/yield of the third blocking-oscillator, passing the cascade/stage of accumulation. In mode/conditions "work" the left half of tube L_8 is closed by the negative voltage, removed from divider/denominator R_{30}, R_{48} because of the current of the right half of tube. During accumulation on the capacitor of the potential, sufficient for the opening/triggering of tube, the left half of tube L_8 opens and due to the voltage drop on the anode of the tube, the neon lamp NL_1, "Accurate" lights up.

The cascade/stage of the indication of call signals is assembled on tube L_6 (6N1P) by the diagram of the waiting multivibrator with positive grid and with cathode coupling. Starting/launching of multivibrator with positive grid and with cathode coupling. The starting/launching of multivibrator is conducted by supply to the grid of the call signal through the toggle switch V_2 by its position "included".

In the circuit of the anode of the right half of tube, is included neon tube the NL_2 "of the call" which is fired in the

presence of call signal.

Construction (Fig. 132). Network elements are mounted on L-shaped chassis/landing gear, on rear wall of which are located couplings P_1 and P_2. To coupling P_1 are conducted supplying voltages, and kA to coupling P_2 - pulse signals. On front/leading wall are mixed the toggle switches of control, indicator lights, potentiometer and sockets for the checking of the work of unit.

Unit of the rectifiers of supervisory equipment.

This unit is intended for the feed of the ranging and azimuth channels of supervisory equipment (Fig. 133). Both channels are supplied from the identical units each of which contains two rectifying equipment/devices and provides the following stresses: +250, +150, -150 V.

Fig. 133. Schematic diagram of the unit of the rectifiers of supervisory equipment.

Key: (1). Regulation. (2). Reg. [illeg.] stability. (3). Grid/network. (4). Illumination. (5). Circuit. (6). Housing. (7). 208V. (8). Hz.

Fig. 134. Unit of the rectifiers of the supervisory equipment: 1 - the protective shade of illumination; 2 - voltmeter; 3 - the toggle switch of the start of the illumination of the scale of voltmeter; 4 - switch; 5 - indicator lights; 6 - in front of keepers; 7- toggle switch of the start of grid/network.

Stress +250 in is obtained from the rectifier, assembled by full-wave circuit on tube L_1 (5Q8S). At the output/yield of rectifier, is included the capacitor S_1 and the electronic regulator, which consists of tubes L_2 - L_4 (6N13S) Ci of resistor/resistances R_2 - R_{21}.

The work of electronic regulator entails the following. With an increase in the output voltage, initial setting up of which is conducted with the aid of resistor/resistance R_{20}. it decreases negative grid voltage of of tube L_6 (6Zh4). The cathode current grow/rises, the drop of voltage on resistor/resistance R_{15} increases. This voltage is supplied to the grids of control tubes L_2-L_4. The resistance of tubes increases and voltage decreases to the nominal value.

During a decrease in the output voltage, negative displacement on the control electrode of tube L_6 increases, the current through the tube of decreases. A voltage drop across resistor/resistance R_{15} and anode resistance L_2-L_4 decreases, output voltage increases to its nominal value.

Voltage +150 is created on tube L_7 (SG4S) and resistance R_{25} which are supplied from stabilized rectifier +250 v through the terminal of 9 couplings P_2.

Voltage - 105 V is received from the rectifier assembled but to full-wave diagram to tube L_8 (5Ts4S). / the filter of rectifier consists of throttle/choke Dr_1, capacitors S_4 and S_5. Output voltage is stabilized with the help of tube L_9 (SG3S) and ballast resistance R_{30} and R_{31}.

The output voltages of power unit are monitored with the aid of the voltmeter of the IP_1 which is connected to different circuits with the help of switch V_2 and of resistor/resistances R_{22}-R_{24}, R_{29}. Current with voltage 208 v and frequency 400 Hz is supplied to the primary windings of transformers Tp_1 and Tp_2 through the switch V_1.

Constructions. Unit is assembled on L-shaped steel chassis/landing gear (Fig. 134).

The cell/elements of electronic regulator are assembled on

separate small detachable chassis/landing gear. On front/leading panel are installed the indicator of voltage with switch, dial lights, safety device/fuses, power switch, the potentiometer of the adjustment of voltage +250 in. On the rear wall of chassis/landing gear of located couplings P_1 and P_2.

end section.

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Chapter VII

STABILIZED DRIVE OF THE ROTATION OF AZIMUTH ANTENNA.

The azimuth antenna is the time/temporary assigning cell/element, and on the constancy of the velocity of its rotation

depends the accuracy of the output parameters of system the RSBN-2 which provides the azimuth determination of aircraft relative to radio beacon with accuracy 0.25°. This error is composed of the errors of the aircraft and ground equipment of system. The error of ground equipment does not exert a substantial influence on common/general/total error when it comprises not more than 0.4 common/general/total errors, i.e., 0.1° (6').

The system of the control of the setting up of azimuth provides setting up the bullet of azimuth with accuracy 4', therefore, the error, caused by the nonuniformity of the antenna scan rate, it must be not more 4.5' (during the quadratic addition of errors).

The accuracy of the measurement of azimuth on on the airplane is ensured, if azimuth antenna rotates by with rate of 100 r/min 0.1o/o. Such high requirements for supported for the constancy of the rotational speed of azimuth antenna are realized with the aid of the stabilized drive of its rotation.

Fig. 135. Unit is the diagram of the stabilized drive of the rotation of azimuth antenna.

Key: (1). Block of actuating motor. (2). Azimuth antenna. (3). Actuating motor. (4). Sensor of tachometer. (5). Rectifier of the stimulator of standard speed. (6). Rectifier. (7). Block basic machines. (8). Direct-current generator of EN-45. (9). Asynchronous electric motor. (10). [illegible] (11). Crystal oscillator. (12). Selsyn sensor. (13). Rectifier. (14). Synchronous electric motor. (15). Selsyn transformer. (16). Phase discriminator. (17). magnetic amplifier. (18). Rectifier controlled. (19). Tachometer is electrical. (20). Stimulator of standard speed. (21). Control board of the rotation of antenna. (22). Cabinet of roll control of azimuth antenna.

Technical specifications of the stabilized drive

the rotational speed of azimuth antenna during the automatic operating mode (at the ambient temperature in limits of 50°C, the speed of the wind to 25 m/s, ice-covered surface, humidity etc.), of r/min.

Rotational speed of azimuth antenna with manual control, r/min.

The maximum accelerations with smooth control of drive, are not more, m/s^2.

Time of the adjustment of the starting/launching of drive, s.

Power, consumed by drive from the three-phase network of alternating current, kW.

Power on the shaft of servomotor, kW.

The same, in work without wind protection and at wind velocity 11-12 m/s, of kW.

Block diagram (Fig. 135). In the composition of the stabilized

drive, enter the following blocks.

1. Control board of rotation the antenna where are placed the organs of roll control of antenna, shielding, commutation, measuring and signaling equipment. Besides this equipment, in panel they are located:

rectifier D_3 for the feed of the winding of the separate excitation of servomotor;

the adjustable rectifier (with magnetic amplifier) for the feed of the independent excitation winding of the direct-current generator of PN-45;

regulated rectifier D_2 for the feed of the field winding of magnetic amplifier.

2. The block of the standard stimulator of rotational speed, which is intended for:

the generation of voltage 220 v with high-stability frequency 50 hect., which feeds synchronous electric motor the SD-60 which provides obtaining the standard rotational speed of aaaaaaa r/min;

the comparison of the given rotational speed of the azimuth antenna of aaaaaaaaa r/min (rotational speed of the selsyn transmitter of BS-4) at the standard rotational speed of the output axis of this engine and output of signal proportional to a difference in these speeds.

Fig. 136. Cabinet of ro.l control of the azimuth antenna: 1 - the unit of the rectifier of crystal oscillator; 2 - the unit of crystal oscillator; 3 - the assembly of roll control of antenna; 4 - the counter of operating time.

The assembly of the stimulator of standard rotational speed consists of:

voltage generator 220 v with frequency 50 Hz with quartz-crystal control;

the synchronous electric motor of SD-60 with the reducer, which reduces the rotational speed of output axis to 60 r/min;

the comparison circuit of speeds.

3. Assembly of the rectifier of the stimulator of standard speed, carried out by the diagram, analogous to the diagram of the rectifier of encoder.

It is structural control board, the stimulator of standard speed and the rectifier of crystal oscillator are placed in the common/general/total strut, named by the cabinet of roll control of antenna (Fig. 136).

4. Unit of the fundamental machines, consisting of three-phase induction motor AOL-51-16 (P = 7.2 kW, U = 200 in, F = 400 Hz, I = 32.1 a, n = 2920 r/min) and direct-current generator of PN-45 (P = 5.2 kW, U = 115 in, I = 45 a, n = 2000 r/min). This unit is intended for the conversion of three-phase alternating current with voltage 208 v and frequency 400 Hz into direct/constant voltage 115 in, necessary for the feed of servomotor. For providing a constancy of the rotational speed of servomotor, the voltage on oscillator is regulated automatically.

5. The block of the servomotor of P-42M (P = 4.6 kW, U = 110 in, I = 53.3 a, n = 1500 r/min), which revolves the shaft of the column of drive through the reducer with a velocity of 100 r/min). The free shaft butt end of the engine through the reducer connect with the sensor of a tachometer of the type of T3-204.

6. Column of drive for the transmission of rotat on from servomotor to the shaft of the antenna and from the shaft of antenna to other nodes, which ensure the synchronous working of beacon (Fig.

137).

In the column of drive, they are placed:

worm reducer 1500:100 r/min;

magnetic sensors with disks on 30, 35; 36 and 180 magnetic inserts;

selsyn transmitter the BS-4 of the comparison circuit of the given antenna scan rate with standard;

selsyn-sensor the BS-2 of the diagram of the synchronization of scanning/sweep PPI;

selsyn SGS-1 for the adjustment of carriage are magnetic sensors;

the revolving coaxial transition.

7. Wind protection of antenna, intended for derating, necessary for the overcoming of the rotational resistance of antenna from ventilator torque/moment, wind loads and the protection of antenna from the action of meteorological residue/settlings and dust.

Functional diagram and operating principle (Fig. 138). The stabilized drive of the rotation of azimuth antenna is the astatic automatic control system, which provides the constancy of the assigned antenna scan rate.

Fig. 137. Simplified kinematic scheme of the column of the drive of the rotation of the azimuth antenna: 1 - electric motor P-42M; 2 - selsyn SGS-1; 3 - selsyn BS-2M; 4 - selsyn BS-4.

Functional diagram of the stabilized drive of the rotation of azimuth antenna.

Key: (1). r/min; (2). Selsyn transmitter. (3). Azimuth antenna. (4). Rectifier. (5). Rectifier. (6). Crystal oscillator. (7). Comparison circuit of rates. (8). SCD 50 from reducer. (9). Selsyn transformer. (10). Phase discriminator. (11). Magnetic amplifier. (12). Rectifier.

The feed of drive is realized from the network of alternating current 208 in, 400 Hz. Voltage is supplied to the converter, which consists of engine M_1 (AOL-51-16) and direct-current generator M_2 (PN-45), from which direct/constant voltage 110 in is supplied to servomotor M_3 (P-42-M). The servomocor through the worm reducer revolves azimuth antenna with a velocity of 100 r/min.

With the axis of the antenna through the reducer, is connected the selsyn transmitter of the comparison circuit of rates whose rotor rotates at a rate of 60 r/min, called the given antenna scan rate.

ab The stimulator of standard rate consists of a-c generator 220 of high-stability frequency 50 Hz and the synchronous motor of SD-60 r/min. With this axis connect synchro-transformer the comparison circuit of rates.

The action of the stabilized drive is based on the comparison of the given rotational speed of antenna with standard with the aid of the comparison circuit of speeds. If the rotors of selsyn transmitter and synchro-transformer of comparison circuit rotate synchronously and in concord, i.e., the aaaaaaaaa and angle of displacement between

them is equal to 90°, then on the output/yield of comparison circuit voltage is equal to zero. This means that the stabilization system is controlled accurately and to servomotor is supplied optimum voltage from direct-current generator M_2, rotated with engine M_1.

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Fig. 139. Block diagram of the stimulator of standard speed.

Key: (1). Crystal oscillator. (2). Forming amplifier. (3). Amplifier and blocking oscillator. (4). Divider/denominator. (5). Divider/denominator. (6). Amplifier. (7). Synchronous electric motor.

(8). Comparison circuit of speeds. (9). Selsyn. (10). Phase discriminator. (11). To magnetic amplifier. (12). r/min. (13). From the selsyn transmitter of antenna.

If the rotational speed of selsyn transmitter above or lower than standard rotational speed of synchro-transformer, appears the synchro-angle and at the output/yield of comparison circuit appears the constant voltage which through the diagram of the automatic breaking of relay R_4, R_2, R_3, the magnetic amplifier of mu, the rectifier D_3, the direct-current generator M_2 affects the servomotor M_3 so that its speed changes to the elimination of the appearing error.

In the stabilized drive accepted hyposynchronous start of automatic control system (ACS) under favorable conditions, i.e., the start occurs at speed lower than standard, but very close to it and at the insignificant synchro-angle. The Hyposynchronousness of start ACS requires the preliminary switching on of the stimulator of standard speed before starting/launching.

During the starting/launching of drive, begins to rotate the induction motor of the unit of the fundamental machines and upon reaching by it of the definite speed is excited oscillator, and then smoothly begins to rotate servomotor and antenna.

When the given antenna scan rate reaches the rate, close to standard, and the synchro-angle of the small and determined sign, at the output/yield of the comparison circuit of rates, is created the insignificant voltage of the determined polarity, sufficient for function relay R_4, and on the direct-current generator of PN-45 - the voltage, close to optimum by which wear/operates the relay R_2 circuit diagram ACS and is self-locked by contacts 1, 6.

After the switching on of relay R_4 and R_2, is supplied the feed to the winding of the relay R_3, through contacts 1, 6 which to the control winding of magnetic amplifier it enters error voltage with the output/yield of the phase discriminator of comparison circuit. Because of this the rotational speed of servomotor smoothly increases before obtaining the synchronous rotation of the rotors of the selsyns of comparison circuit. Subsequently the rotational speed of servomotor is supported by constant. During the function of relay R_3, its contacts 4, 9 are broken and disrupt the feed circuit of the winding of polar relay R_4, on the control winding of magnetic amplifier remains that which was connected to phase discriminator, since the feed of relay R_2 is realized through its contacts 1, 6.

The disconnection/cutoff of control winding can be produced by

switch V_2 or as a result of a decrease in tension of direct-current generator for any reason.

Stimulator of standard speed (Fig. 139). As the basis of current rise with voltage 220 v and frequency 50 Hz, is placed the following principle. Sinusoidal frequency variations of frequency 10 kHz, obtained with the aid of crystal oscillator, are converted into the momentum/impulse/pulses, the repetition frequency of which then is reduced to 50 Hz with the aid of frequency dividers.

Fig. 140. The schematic diagram of the block of crystal oscillator.

Key: (1). Frequency of aaaa Hz. (2). Hz. (3). Amplitude 50 Hz. (4). Circuit. (5). Housing. (6). in. (7). Hz. (8). Rotor of receiving synchro. (9). Signal. (1). error.

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From the obtained sequence of momentum/impulse/pulses, are isolated the fluctuations of the fundamental frequency 50 Hz and they are amplified to the voltage 220 in, necessary for the feed of the synchronous electric motor of SD-60.

The schematic diagram of the block of crystal oscillator (Fig. 140). The fundamental cell/element, which determines the frequency stability of output voltage, is the crystal oscillator, employed for the generation of the sine voltage of high-stability frequency 10 kHz.

Crystal oscillator is carried out on the left half of tube L_1 (6N1P) by diagram with capacitive feedback and incorporation of the quartz between the control electrode and the anode. Voltage 10 kHz frequency, removel from duct L_1, C_4, C_5, is supplied to amplifier-limiter on tube L_2 (6J1P). The cascade/stage of limitation works in the mode/conditions of bilateral limitation on maximum because of limitation in grid circuit, and on the minimum - because of the cutoff of anode current. The obtained square pulses are

differentiated by circuit C_9, R_{13}, they are amplified by pulse amplifier and are supplied to the starting/launching of the delayed blocking oscillator on tube L_3 (6N1P).

Blocking oscillator wear/operates, and from the third winding of transformer Tr_1 is taken the positive pulse, which is supplied to the first frequency divider. In the unit of crystal oscillator, are applied four divider/denominator, the ensuring two-hundredth frequency division of the sequence of momentum/impulse/pulses.

The first three divider/denominators are assembled on the diagram of the waiting blocking oscillator on tube L_5 (6N1P) and the right half of tube L_1 with storage equipment/devices on tubes L_4 (6X2P), L_6 (6X2P), L_7 (6X2P). In the first and second divider/denominators storage equipment/device is included in the circuit of the control electrodes of the tubes of blocking oscillators.

storage equipment/device of the first divider/denominator, which consists of capacitors C_{17}, C_{18} and the fixing tube L_4, is included in the circuit of the control electrode of the left half of tube L_5.

Capacitors C_{17} and C_{18} form the capacitive voltage-divider from which is remove/taken the voltage on monitoring jack G_3. Potentiometer R_{20} serves for the establishment of the multiplicity of the frequency division of the sequence of momentum/impulse/pulses by the adjustment of the initial stress level on capacitor C_{17} and on the control electrode of the tube of blocking oscillator.

In the absence of charge on capacitor C_{17} and of negative voltage on the control electrode of the left half of tube L_5, the blocking oscillator is excited. At this moment because of grid cathode currents, occurs the charge of capacitor C_{17}. Fixation of the maximum stress level on capacitor C_{17} is conducted by the tube L_4, to first accelerator of which is supplied negative voltage from divider/denominator R_{19}, R_{20}, R_{21}. If during blocking-process stress level on capacitor C_{17} is higher than the voltage, removed from divider/denominator, then capacitor C_{17} will discharge itself on the circuits: capacitor C_{18} is resistor/resistances R_{21}, R_{20}, R_{22} is a tube L_4 to the voltage, removed from divider/denominator.

Momentum/impulse/pulses from the secondary winding of transformer Tr_1 through capacitor C_{16} approach the anode of the left half of tube L_4, which in the pulse separations it is discharged

through the right half of tube L_4 to the level of the fixing stress, removed from divider/denominator. the stress of aaaaaaaaaa; therefore the left half of tube L_4 is closed and capacitor discharge C_{17} does not occur.

During the supplying of positive pulses from transformer Tr_1, occurs stepped capacitor discharge C_{17} through capacitor C_{16}. This leads to a stepped variation in the grid voltage of the left half of tube L_5 (Fig. 141a) and after the admission of the fifth positive pulse tube triggers itself, in consequence of which it appears blocking-process.

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Fig. 141. Diagram/curves of voltage, which elucidate work of divider/denominators.

In this case, again occurs the charge of capacitor C_{17} (see Fig. 140) and impulse shaping which from the secondary winding of transformer Tr_2 is supplied to the following divider/denominator. The multiplicity of division in the second divider/denominator is establish/installed by potentiometer R_{25}.

Analogous processes takes place in the third divider/denominator, with by that only difference, that storage equipment/device is included in the cathode circuit of the right half of tube L_1 blocking oscillator. This tube is closed by the voltage, removed from divider/denominator P_{29}, R_{30}, R_{31}. Potentiometer R_{30} serves for the adjustment of the multiplicity of the frequency division of the sequence of momentum/impulse/pulses.

After the admission of negative pulses from the secondary winding of transformer Tr_3, capacitor C_{25} gradually charges itself ($C_{25} << C_{26}$). Because of this the displacement of aaaa (Fig. 141b) on the control electrode of the right half of tube L_1, decreases and with the admission of the fourth negative pulse the tube triggers itself, appears blocking-process. As a result of this, occurs the capacitor discharge C_{25} through the right half of tube L_1 and the formation of the momentum/impulse/pulse which is supplied to the

following divider/denominator (see Fig. 134b).

The fourth divider/denominator is assembled on tube L_9 (6N1P) by the diagram of the waiting multivibrator with cathode coupling, with two stable positions. Square pulses (aaaaaaa Hz) from part of anode loads (R_{35}, R_{43}") of the tubes of the multivibrator through the integrating circuits R_{39}, C_{34}, C_{45}, C_{35} is supplied to the control electrodes of terminal push-pull tuned amplifier on the tubes of L_{10}, L_{11} (6P3S). The input voltage of terminal amplifier is regulated by the doubled potentiometer R_{48}.

From output transformer Tr_5 the current with voltage 220 v and frequency of 50 Hz, approaches winding synchronous electric motor M_1 (SD-60), mechanically connected by a contactless selsyn M_2 (BS-4), that work in transformer mode/conditions in the comparison circuit of rotational speed. With light load the rotational speed of synchronous motor is determined only by frequency of the feeding voltages but the stability of the velocity of its rotation - by frequency stability.

The comparison circuit of velocities is intended for the comparison of the given antenna scan rate of aaaaaaaa r/min with the

standard rotational speed of the rotor of the synchro-transformer (BS-4), connected mechanically with the electric motor of SD-60.

This diagram consists of the synchro-transformer, the rotational speed of which is standard aaaaaaa r/min), the phase discriminator (phase discriminator), assembled on diodes D_1, D_2 (Fig. 142), and the selsyn transmitter (BS-4), connected with gear drive with the shaft of azimuth antenna.

The three-phase windings of synchro-transformer are connected with the appropriate windings of selsyn transmitter. To the single-phase winding of selsyn transmitter, is supplied the current with voltage 45 v and frequency 400 Hz from the secondary winding of transformer Tr_7.

Fig. 142. Fundamental ccmparison circuit of speeds.

Key: (1). Selsyn transmitter. (2). Synchro-transformer. (3). in. (4). Hz. (5). Error voltage.

The action of this diagram is based on the property of selsyn system which lies in the fact that voltage across terminals of the single-phase winding of synchro-transformer changes according to the cosinusoidal law of dependence on displacement angle between the rotors of the selsyns:

where the aaaa are the maximum voltage on single-phase the windings of synchro-transformer; θ - displacement angle between the rotors of selsyns; ω is an angular voltage frequency of network (f = 400 Hz).

As the coincidence of the rotors of selsyns, is accepted such, by which the load voltage of the single-phase winding of synchro-transformer is equal to zero.

The voltage in the single-phase winding of synchro-transformer is induced only with the mismatched position of the rotors of selsyns. The value of this voltage is determined by the degree of disagreement/mismatch, and phase - by the sign of disagreement/mismatch.

Similar pattern is observed during the simultaneous rotation of

the rctors of selsyns. If rotors rotate synchronously and in concord, i.e., at identical speed and at each point in time are shifted between themselves by angle of 90°, then the voltage in the single-phase winding of synchro-transformer is not inducted, i.e., error voltage is equal to zero. As soon as is disrupted the equality of speeds, is disrupted the coordination of the position of rotors, the as a result of which in single-phase winding synchro-transformer appears error voltage (f = 400 Hz). The value of this voltage depends on displacement angle, and phase on togas, which selsyn rotates faster. In this case, the voltages in the single-phase windings of selsyn transmitter and synchro-transformer are cophasal or antiphase.

The variable of voltage mismatching is converted into the voltage of the direct current with the aid of the phase discriminator in which as reference voltage is utilized the voltage, which feeds the excitation winding or selsyn transmitter. For this, from the single-phase winding of synchro-transformer, the error voltage is supplied to the primary winding of transformer Tr_6 phase detector, and reference voltage is remove/taken from the secondary winding of transformer Tr_7, connected to the midpoint of the secondary winding of transformer Tr_6.

Fig. 143. The diagram/curves of voltages which elucidate work of the comparison circuit of the speeds: I - the mode/conditions of the rotation of selsyns nonsynchronous; II - synchronous, but mismatched; III - synchronous and matched; a and b are voltage on the secondary winding of transformer Tr_6; c - the reference voltage of phase discriminator; d and e - the resulting voltages on diodes D_1 and D_2 respectively; f are stress on the loads of diodes; g - the resulting output potential of phase discriminator.

Thus the voltage of the error signal on diodes D_1 and D_2 is supplied to antiphase, but supporting/reference - in phase. Consequently, on one diode the resulting voltage is equal to sum, and on the second - difference in the applied voltages.

From the torque/moment of launching/starting and to the torque/moment of the function of the diagram of the automatic velocity control of the rotation of servomotor occurs the lack or synchronation and the mismatch of the rotation of selsyn transmitter and synchro-transformer, since $d\theta = \Omega dt$ (Ω - a difference in the rotational speed of the rotors of selsyns).

As a result of this in single-phase winding synchro-transformer are inducted the balance-modulated fluctuations. These fluctuations through the transformer Tr_6 are supplied to diodes D_1 and D_2 in antiphase (Fig. 143a, b). The diodes D_1 and D_2, affects the resulting voltage (Fig. 143d, e). After detection are created the voltage (Fig. 143f) on the load resistor/resistances of diodes and resulting voltage of mismatching (Fig. 143g). The amplitude of output voltage depends on the parameters of output filters. With approach/approximation to the moment of syncnronization the frequency of the balance-modulated oscillations decreases, and the amplitude grow/rises.

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At the torque/moment of the synchronization of oscillation in the single-phase winding of synchro-transformer, they become unmodulated, amplitude and their phase respectively depend on the value of angle and sign of disagreement/mismatch (Fig. 143, II). To diodes D_1 (see Fig. 142) and D_2 it affects the total and differential voltage; therefore as a result of detection on the load of phase discriminator R_{31}, R_{32}, is created the direct-current voltage of the error signal whose level and polarity are determined by angle and the

sign of disagreement/mismatch. error voltage from the load of phase discriminator is supplied to the control winding of magnetic amplifier.

During the synchronous and matched rotation of the rotors of selsyns in the single-phase winding of synchro-transformer, the error voltage is absent, on diodes D_1 and D_2, operates the only reference voltage; therefore output potential of phase discriminator equal to zero.

For a visual test of the rotation of supporting/reference selsyn M_2, serves the tube LN_2, which flashes during the closing/shorting of the contact group of KG_1 as the cam/catch/jaw, established/installed on the shaft of selsyn.

For the preheating or the lubrication of the reducer of the electric motor of SD-60 at temperature below -25°C by tumbler V_1 is included the feed to heating element $N3_1$, in this case lights up the warning lamp LN_1.

schematic diagram of electric drive. Figure 144 shows the only schematic diagrams of the block and nodes, which directly participate in the antihunting circuit of the rotational speed of azimuth antenna and necessary for understanding the physical processes, which proceed in stabilization system during different mode/conditions.

Current with voltage 208 v and frequency 400 Hz through the automatic machine of protection Av_1 control board and the switch V_1 "launching/starting - work" the drive of antenna is supplied to the synchronous squirrel-cage motor M_1 the unit of the fundamental machines. In the position of switch V_1, "launching/starting" or "work" of the excitation winding of engine M_1 respectively are connected by star or triangle.

Engine M_1 is connected by axis with direct-current generator M_2. From the terminals of the oscillator through the ammeter IP_1 and the automatic machine of protection Av_2, the voltage approaches the grippers of the anchor chain of performing motor M_3. As servomotor is utilized the electric motor of direct current are compounded, with series-wound winding, the type of P-24M (by diagram accepted as independent constant excitation). The characteristic of motor approximately is described by equation

where n - the rotational speed of engine; U - the line voltage; I - the current of the of armature of circuit; R - the armature resistance, brush contact and supplementary external resistor/resistances in anchor chain; C is design constant of engine; f - magnetic flux of one pole.

From this equation it is evident that a change in the speed of servomotor can be conducted by a change in the feeding stress, current of anchor chain, resistor/resistance and magnetic flux. In the stabilized drive the velocity control of rotation it is conducted by a change in the feeding stress, however, since in servomotor there is series-wound winding, go a change in the stress will produce change in the current of anchor chain and magnetic flux.

For maintaining the constancy of the rotational speed of

servomotor M_3, is required this change in the voltage of the generator, which would compensate for all reasons, affecting a change in the rotational speed of servomotor.

Fig. 144. Schematic diagram of the drive of rotation azimuth antenna.

Key: (1). Launching/starting. (2). Work. (3). V. (4). mA. (5). Manual. (6). Automatic. (7). "network". (8). Remote IP_4 tachometer. (9). Manual control. (10). Automatic control. (11). Hz. (12). Earth/ground. (13). Alternating (14). Voltage. (15). signal. (16). error. (17). Selsyn. (18). Alternating current. (19). Unit of the fundamental machines. (20). Antenna n = 100 r/min. (21). Unit performing. (22). Magnetic sensor. (23). Selsyn transmitter. (24). Engine. (25). Stimulator of standard speed.

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Fig. 145. Curve of magnetic permeability of Permalloy.

Key: (1). Operating region.

This is achieved by the self-adjustment of coil current of the excitation of oscillator (OVG) with the aid of the magnetic amplifier of the MU_1, through the wirding of alternating current of which is supplied the voltage on rectifier D_3 the feeding OVG.

Magnetic amplifier MU_1 has two windings of direct current - magnetic biasing II, the manager III and two windings of alternating current I, I connected in the circuit of rectifier D_3 so that emf, induce in the windings of direct current, are compensated for.

Field winding is utilized for fixation of the position of operating point on the characteristic of the curved magnetic permeability of core $\mu = f$ (i) and manual control. By a change in the current of control winding III is conducted the regulating of the value of common/general/total inductance and common/general/total winding impedance I, I to alternating current in the mode/conditions of automatic control.

It is known that between magnetic intensity H and the value of current i, which takes place on conductor, there is relationship/ratio $H = ki$ (k is a proportionality factor). Therefore

the dependence of magnetic permeability μ core from the Permalloy, placed inside the coil over which flow/lasts direct current, from the value of the latter, will be the same as its dependence from H (Fig. 145).

During a change of the direct coil current of magnetic biasing or in control winding changes magnetic permeability and, consequently, also inductive reactance X of windings I, I which is equal

where L - the inductance of the winding of alternating current with core.

In turn,

where L_0 is inductance of the winding of alternating current without core.

The operating point of the characteristic of magnetic amplifier

is selected on the falling/incident section of dependence $\mu = f(i)$; therefore with an increase in the current, which takes place through the winding, magnetic permeability of its core falls, and during a reduction in current, it grow/rises.

With simultaneous participation in the operation of both windings of direct current (magnetic biasing II and of the manager III) is created the resulting magnetic field. If the magnetic flux of control winding III coincides in the direction with the magnetic flux of field winding II, then decreases the inductive reactance of windings I, I, and voltage fed to the rectifier D_3, the current through the OVG, voltage on oscillator PN-45 and the rotational speed of servomotor increase. If the magnetic flux of control winding III is contrary magnetic flux of the winding of magnetic biasing II, then the inductive reactance of windings I,I increases, and the voltage, applied to rectifier D_3, the current through the OVG, voltage on oscillator PN-45 and the speed of the rotation of servomotor decrease.

For understanding the destination of the separate network elements and phased processes in it, let us examine the different forms of the operating modes of drive.

Starting/launching mode/conditions and manual control. The fundamental destination of this mode/conditions is the provision for self-excitation of oscillator and the smooth start of drive (without considerable electrical and mechanical overloadings). This is reached by the determined sequence of the fulfillment of operations and commutations of diagram.

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The condition of smooth start is the change in the field current of oscillator the proportional to its rotational speed, i.e., the self-excitation of oscillator, which is achieved by the creation of positive feedback between the circuit of armature and its independent excitation winding (OVG) by means of the connection of the field winding 11 of magnetic amplifier of MU_1 to the circuit of the armature of generator.

During the launching/starting of drive, the switch $_1$ is

establish/installed in the position "star", by which the winding of synchronous motor M_1 is connected by star, the coil of relay R_1 is de-energized and the contacts of relay are located in the position, indicated in Fig. 144. Through locked contacts 2, 7; 4, 9 relay R_1, the field winding II of magnetic amplifier of MU_1 is connected up to the grippers of the armature of generator.

Induction motor begins to rotate, without experience/testing special load, since field current is very small, and gradually increases rotational speed.

With an increase of the rotational speed of the armature of generator, is raised the voltage on the oscillator of PN-45, thanks to which increases coil current of magnetic biasing II, decreases the inductive reactance of windings I, I connected in the circuit of rectifier D_3, and therefore increases coil current of the excitation of oscillator. An increase in the coil current of excitation produces boosting on oscillator etc., i.e., occurs the usual process of the self-excitation of direct-current generator. The rate of the process of the excitation of oscillator is regulated by variable resistance R_9, connected in the circuit of field winding II. When the power of oscillator is sufficient for the overcoming of the moment of

frictional forces, servomotor begins slowly to gain speed.

When the rate of servomotor M_3 increases to the nominal for this mode/conditions (1100-1300 r/min), switch V_1 sets in position "work". In this case, the rate of induction motor increases, the winding of relay R_1 through the rectifier D_1 is connected up to the first and second phases, relay wear/operates and through contacts 5, 10 and 1, 6 it connects up the field winding II of magnetic amplifier to regulated rectifier D_2.

Resistor/resistance R_6, included in the circuit of rectifier during the setting up of the switch of mode/conditions V_2 in position "manual", makes it possible to establish/install operating point on the characteristic of the magnetization of the core of MU_1 and if necessary to realize smooth manual voltage regulation on oscillator and rotational speed of servomotor in limits of 15o/o from datum speed.

The knob/stick of resistor/resistance R_6 and switch V_2 are derived on the front/leading panel of control panel of the rotation of antenna.

Mode/conditions of automatic control. The translation/conversion of drive in the mode/conditions of automatic control is realized by a setting up of switch V_2 at position "automatic". In this case, the field winding II of magnetic amplifier MUts remains that which was connected to regulated rectifier D_2, but the current control of magnetic biasing is conducted by resistor/resistance R_7. Furthermore, is prepared for work the diagram automatically of the connection of control winding III of magnetic amplifier of MU_1 to the output/yield of the phase discriminator of the comparison circuit of speeds.

The last/latter diagram consists of relay R_2, the r, polar relay R_4, starting rheostat R_{12} R_{18}, serving for the limitation of the current of control winding III during its incorporation, variable resistance R_{11}, which controls mΩ of the incorporation of relay R_2.// during the setting up of switch V_2 into position the "automatic" winding of relay R_2 and R_3 the are connected to the minus circuit of oscillator M_2.

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Before the function of the diagram through contacts 2, 7, relay R_3 to phase discriminator is connected resistor/resistance R_{10}; therefore with the presence of the disagreement/mismatch of selsyns instrument IP_3 shows current within limits from -10 to +10 mA.

If the rotational speed of selsyn transmitter is below or higher than the rotational speed or synchro-transformer, then on the output/yield of phase discriminator voltage changes with difference frequency and the rifleman/gunner of the instrument of IP_3 oscillates with the difference frequency of aaaaaaaaaa within limits from -10 to +10 mA.

At the rotational speed of selsyns, close to synchronous, the oscillation frequency of arrow/pointer decreases and with the aaaaaaaaa of beat of pointer they will be discontinued. At synchronous speed, but with the presence of error angle of selsyns, the needle indicates the constant value determined by degree and the sign of the mismatching of selsyns.

At sufficient the stress levels on the output/yield of phase discriminator the armature polarized relay R_4 is force against left contact, closing the circuit of the power supply of relay R_2.

Relay R_2 wear/operates, is self-blocking by contacts 1, 6 a by contacts 5, 10 it closes feed circuit relays R_3. Simultaneously breaking contact 4, 9 relay R_2 disconnect warning lamp LN_9 "manual", and closing contacts 5, by 10 relays R_3 switch on warning lamp the LN_8 "Automatic" which indicates about the start of the mode/conditions of automatic control.

Variable resistance R_{11} the "setting up of the torque/moment of the switching on of automation", connected in series with the coil of relay R_2, is intended for the selection of the voltage of the switching on of relay at the definite rotational speed of the armature of servomotor.

The optimum hyposynchronous switching on is achieved by the consecutive function of relay R_4, R_2 and R_3.

The polar relay R_4, controlled by the voltage of the error signal from the output/yield of phase discriminator, is regulated so that its function occurs under current strength to 10 mA, i.e., at small displacement angles, which contributes to the smooth entry of servomotor into the mode/conditions of automatic regulation. The function of this relay provides the favorable switching on of control winding III on the synchro-angle.

The feed of the winding of relay R_4 is realized on the circuit: phase discriminator - instrument IP_3 is the second board of switch V_4 in position "launching/starting" - the winding of relay R_4 is breaking contact 4, 9 relay R_3.

The winding of relay R_2 is supplied from the oscillator of PN-45 on the following circuits: oscillator PN-45 is the third board of switch V_4 in position "launching/starting" - contacts 2, of 3 polar relays R_4 are resistor/resistance R_{11} - the winding of relay R_2 is contacts 2, 4 switches V_2 - oscillator PN-45.

During the function of relay R_3, breaking contact 2, 7 and 4, 9 disconnect the winding of polar relay R_4 and resistor/resistance R_{10} from phase discriminator, but circuit closing contacts 1, 6 switch on the control winding of the magnetic amplifier of the MU_1 through starting resistance R_{12} - R_{18} switch V_4.

During the rotation of this switch from position "launching/starting" to position "work" are disconnected consecutively resistor/resistances R_{18} - R_{12} without the breaking of current.

In order to avoid high voltages on control (overcontrol) is recommended after the ignition of the tube of LN_8 "automatic" the derive/concluding of resistor/resistances R_{18} - R_{12} with the lazy turnaround of the handle of switch V_4.

The mode/conditions of automatic control begins from the torque/moment of the switching on of control winding III.

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As the visual display of the accuracy of maintaining the constancy of the antenna scan rate serves the stability of the position of the arrow/pointer of the instrument of IP_3. In this case, it is necessary to keep in mind that the rifleman/gunner must not compulsorily be found on zero. The zero position of arrow/pointer is a special case and testifies to the absence of displacement angle between the selsyn transmitter and the syncnro-transformer.

Construction of the cabinet of roll control of azimuth antenna (cabinet of UVA). In this cabinet are placed the unit of rectifiers for the feed of the stimulator of standard rate, the unit of the stimulator of standard rate (unit of crystal oscillator), control board.

Structurally the unit of rectifiers is carried out detachable.

On its front/leading panel are arranged:

voltmeter with switch to four positions;

the switch of the feed of the power transformers of rectifiers;

safety device/fuses with signal neon tubes Pr_1 (see Fig. 144) to 3 a in circuit (208 in 400 Hz) feed rectifiers Pr_2 to 0.25 a in the circuit (208 in, 400 Hz) of the feed of transformer Tr_3 illumination and signaling; Pr_3 to 0.25 a into circuit +300 in;

the axis of potentiometer R_{14} the adjustment of voltage +300 in;

the switch of the dial light of the scales of voltmeter.

The unit of stimulator standard speed is also carried out detachable. On its front/leading panel is derived the axes of

potentiometers R_{20}, R_{25}, R_{30} for adjustment the coefficient of the division of divider/denominators and the axis of the paired potentiometer R_4 for the amplitude control of output voltage. Besides these organ/controls of adjustment, on front/leading panel are placed the tubes, signalling about the rotation of the armature of the electric motor of SD-60 and about the switching on of the preheating of the electric motor before launching/starting with temperatre below - 25°C.

The control board is the tight part of the cabinet of UVA.

On its front panel are concentrated all the operational controls and control:

teletachometer IP_4 for the measurement of the rotational speed of servomotor;

the indicator IP_3, which controls the stability of the antenna scan rate;

ammeter IP_1 voltmeter IP_2, that measure the current strength and the voltage of the servomotor of P-42M;

automatic machine Av_1 "network";

switch starter the "drive of antenna" on three positions;

the knob/stick of variable resistance R_6 for the manual velocity control of the rotation of antenna;

selector knob V_4 starting rheostat R_{12} - R_{18} automatic control;

the switch of the mode/conditions of control [illegible] "manual is automatic" and the corresponding warning lamps of LN_9 and LN_8;

safety device/fuses with signal neon tubes Pr_1 to 5 a in the

circuit (208 v, 400 Hz) of the feed of power transformers rectifiers, Pr_2 to 5 a in the circuit (5.8 c) of the feed of the dial lights and signaling.

In the lower part of the panel of control behind small doors are placed the nonoperational controls and control:

the automatic machine of protection Av_2 the anchor chain of the oscillator of PN-45; milliammeter IP_5 in the energizing circuit of the oscillator of PN-45;

milliammeter IP_6 in the circuit of the field winding II of magnetic amplifier;

ammeter IP_7 in the energizing circuit of actuating motor;

the axis of variable resistance R_9 for the setting up of current strength the constant magnetic biasing of magnetic amplifier during launching/starting (setting up of the duration of

launching/starting);

the axis of the alternating/variable resistance R_7 for the setting up of the current strength of constant magnetizing during automatic control;

the axis of variable resistance R_{11} for the setting up of the torque/moment of the switching on of automatic control;

monitoring jacks G_1 and G_2 magnetic sensor are thirty-degree markers and the sockets G_3 and G_4, to which is fed current with voltage 220 v and frequency 50 Hz from crystal oscillator. These sockets are utilized with oscillographic checking and the regulation of the optimum antenna scan rate.

Fig. 146. Unit is the diagram of the electric power supply of radio beacon.

Key: (1). Diesel generator. (2). Converter. (3). V. (3a). Hz. (4). Light protection. (5). Cable. (6). Illumination of body. (7). Cabinet of roll control of azimuth antenna. (8). Cabinet of the radio station of communication/connection. (9). Panel of cable inlets. (10). Cabinet of feed. (11). fireplace-fan. (12). AKK OSVE5. (13). Local blowout. (14). Central blowout of front/leading wall. (15). Local blowout. (16). Central blowout of rear wall. (17). Supplementary blowout of rear wall. (18). Front/leading wall of body. (19). the rear wall of body. (20). [illegible] (21) Air blowing. (22). Cabinets.

Chapter VIII

ELECTRIC POWER SUPPLY.

The electric power supply of radio beacon is realized from the mobile electric generator of PES-6 (Fig. 146) mo5nost6h 30 kW by a three-phase current, with voltage 208 v and the frequency 400 Hz, mounted on biaxial trailer. Power plant works both in the self-contained mode/conditions and from the usual network of three-phase current 380/220 in, 50 Hz. With feed from mains 380/220 in, 50 Hz is utilized converter VPL-30, in this case the power input it is approximately 55 kW. In self-contained mode/conditions are used two diesel-electric aggregate/units of AZ-30, that work in turn.

Converter VPL-30 is the automatically adjustable machine converter, which consists of:

asynchronous electric motor with short-circuited rotor P = 37 kW, U = 380/220 in, I = 80/140 a, f = 50 Hz);

the alternator, made on one shaft with electric motor in common housing (P = 30 kW, U = 208 in, I = 104 a, f = 390 Hz, n = 2320 r/min);

driver with the carbon regulator of voltage;

control board.

Fig. 147. Cabinet of the feed of the radio beaccn: 1 - charge equipment/device; 2 - the panel of the switching on of the feed of radio beacon; 3 - the panel of the start of the fans of blowout.

Diesel [oscillator AZ-30 includes:

Diesel engine 4AZ-M204G (P = 60 h.p., n = 1500 r/min);

alternator GSK-30 (P = 30 kW, U = 208 in, I = 104 a, cos ϕ = 0.8, f = 400 Hz, n = 1500 r/min);

driver with the antihunting circuit of voltage and frequency;

control board.

All aggregate/units through the automatic machines of protection can be connected to one of the two cables, which connect power plant PES-6 with apparatus cabin.

The diagram of the connection of the aggregate/units of power plant to apparatus cabin provides transition from one aggregate/unit to another, without interrupting work of radio beacon. The value of

the power input of apparatus cabin depends on the mode of work of radio beacon, conditions of work and value of increment load.

during the nominal operating mode of equipment, presence of the wind protection of azimuth antenna, disconnection of part of the increment load, which does not affect the work of radio beacon, the power input of the network of three-phase current 208 in, 400 Hz is approximately 23 kVA (16.7 kW with factor of power 0.725).

The maximum power input of approximately 27 kVA (21 kW) under the following conditions: azimuth antenna rotates at wind velocity 10 ms without wind protection, are included all fans of body, charges itself one of the storage batteries by current 10 a and entire equipment for radio beacon works with full load. The current of the most loaded phase at the maximum power input does not exceed 78 a.

Electric power supply on triple-core cable will be feed/conducted to the panel of the cable conclusion/derivations of apparatus cabin and further on indoor wiring to the cabinet of the feed from which it is distributed to all cabinets (struts) of beacon.

diagram of feed has some special feature/peculiarities, caused by the requirements for technical specifications.

1. In all cabinets and panels on output blocks, is accepted the following order the destination of the terminals:

terminal 1 - the earth/ground;

terminals 2, 3, 4 are a respectively of the first, second and third phase of three-phase current with voltage 208 v and frequency 400 Hz;

terminal 20 or the last/latter terminal of the block of cabinet is voltage 27 in the direct current of control circuits.

2. All relay and the contactor, used in radio beacon, direct current are supplied either from rectifiers or from storage battery.

3. Power circuits are shielded by adjusting automatic machines and partially by safety device/fuses. Automatic machines have thermal and electromagnetic protection. voltage will be feed/conducted to the upper terminals of automat, and it is remove/taken from lower. Besides the main protection in the cabinet of feed, each cabinet has its protection and a switch. In alternating current circuits with voltage 208 v and frequency 400 Hz in parallel to safety device/fuses are connected the signal neon tubes which are fired with blowing. In direct-current circuits, this signaling is absent.

4. Signaling about damages is sonic and visual (firing of the tubes of red color). Tubes with green and milky light filters indicate the normal operation of one node or the other.

5. The illumination of measuring instruments is self-contained. Each cabinet has its transformer of illumination 208/6.3 in.

6. The diagram of feed from storage batteries - single-wire, is

grounded minus.

7. All selenium rectifiers are blown off/out.

8. All the metallic parts of the apparatus cabinet are grounded by parallel wires to the main grounding busbar which is derive/concluded outside for the connection of the grounding duct.

The main grounding busbar of radio beacon - copper band 13.5 x 1.68 mm in size/dimension is laid on sex/floor and walls within auto. All network elements of ground - units, cabinets, the metallic parts of the auto and chassis/landing gear - connect themselves to the main busbar by parallel wires. For the connection of wires in the framework/bodies of cabinets, are bolts.

Radio beacon is grounded by two metallic colas, clogged into the earth/ground. The Coles are connected by copper patch cords with two terminals, derived outside to chassis/landing gear of auto. Terminals are connected with chapter with the grounding busbar and are closed by screw cover for a protection from dirt. the colas of grounding are

placed in cabinet with entrenching tool.

9. The mounting of the diagram of power electric power supply is made by the wire of the brand of BPVL. Wires outside apparatus cabin are included into durite tubes.

End section.

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Cabinet of feed.

The diagram of the cabinet of feed (Fig. 147) allows:

to distribute electric power supply by the users of energy;

to shield the instrumentation of radio beacon and external mains during overloadings and short circuits;

to charge the battery rooms of the batteries of auto, illumination and radio station;

to monitor voltage and current frequency of external mains, the voltage and the current strength of the charge of storage batteries;

to signal about the disturbance/breakdowns in mains 208 in, 400 Hz, breakdown of any of the blowers, cooling equipment, and about the malfunction of rectifier 27 in control circuits;

to automatically convert power supply of lighting circuits from the storage battery in the absence of the line voltage of alternating current;

to signal and to accept conditional sound signals.

Functional diagram (Fig. 148). The feed of the cabinets of the fundamental electronic equipment is realized through a series of the series-connected automatic machines Av_1, Av_7, Av_{13} and automatic machines or switches, which are located in these cabinets.

Fig. 148. Functional diagram of the cabinet of feed.

Key: (1). [illegible] (2) Emergency lighting. (3). [illegible] (4). Illumination of body. (5). Rectifier of the circuits of control. (6). Illumination of the scales. (7). Cabinet. (8). Diagram light signaling and phase indicator. (9). Switching circuit of feed. (10). Blower. (11). Local blowout. (12). Hz. (13). Central the blowout of front/leading wall. (14) / charger. (15). Local Are blowout. (16). Central blowout of front/leading wall. (17). Fans of body. (18). External key. (19). Supplementary blowout of rear wall. (20). Cabinet cf roll control of azimuth antenna. (21). Cabinet of the radio station of communication/connection. (22). Chimney fan. (23). Battery lighting. (24). Front wall. (25). Rear wall. (26). Rear wall.

In diagram is provided light and sound communication during the non-normal and emergency modes which can arise with the incorrect sequence of the inclusion of automatic machines or with overloading in the process of operation.

Alternating three-phase current by voltage 208 v and with frequency 400 Hz through the panel of cable inlet is supplied to terminals 2, 3, 4 cabinets of feed, but from them - to automatic machine Av_1 "Common - network'" and to the phase indicator of the checking of the correctness of the alternation of the phases of applied voltage.

After the start of automatic machine Av_1, this current approaches:

the cabinet of roll control of azimuth antenna;

the cabinet of the radio station of RSIU-4;

automatic machine Av_7 "fans";

automatic machine Av_2 the "ventilation of body";

charger;

transformer Tr_3 208/6.3 v for the feed of the dial lights of instruments and tubes of signaling;

transformer Tr_2 208/27 into the illuminations of body and light protection;

the winding of relay R_5 and R_6 the switching circuit of feed through the rectifier D_3.

During the function of these relays, alternating current with voltage 27 v through the circuit closing contacts by three separate lines respectively through safety device/fuses Pr_3, Pr_4, Pr_5 is

supplied to loads (tubes). In the absence of alternating voltage, the relays R_5 and R_6 are de-energized direct/constant voltage 27 in the storage battery of illumination "Battery lighting" through the connected automatic machine Av_5 and the breaking contact of relay R_5 and R_6 it approaches the feed of emergency light, light enclosure and repair baffle/socket.

Fig. 149. Schematic diagram of the cabinet of feed.

Key: (1). Rectifier of the charge of batteries. (2). Rectifier charge. (3). Sockets. (4). It is dim. (5). Is bright. (6). Phase indicator. (7). Target/purpose. (8). Housing. (9). in. (10). Hz. (11). Signal. (12). Front/leading wall. (13). tube. (14). Rear wall. (15). Supplementary blowout of rear wall.

The feed of the electric motors of the fans of body is conducted through the automatic machine of protection Av_2 and the switches, arrange/located in the body of machine. kamii-fan is connected up to mains with the aid of the plug to which is supplied the line voltage 208 in, 400 Hz through the automatic machine of protection Av_3.

Upon the start of the automatic machine of protection Av_7 "fans" the voltage approaches automatic machines Av_8, Av_9, Av_{10}, Av_{11}, Av_{14} the blowers of the blowout of equipment, automatic machine Av_{12} the mains unit of control circuits 27 in (rectifier of control) and automatic machine Av_{13} "transmitters".

The automatic machines of blowers and mains unit circuits of control have the supplementary contacts, connected in the diagram of signaling. Automatic machine Av_{14} has one supplementary contact, and automatic machines Av_8-Av_{12} are one closing even one breaking supplementary contacts (supplementary contacts on functional diagram are shown next to automatic machines).

The breaking supplementary contacts of automatic machines are utilized for a current feed with voltage 5.8 v on the warning lamps

of the red world/light of $LN_{12}-LN_{17}$; therefore by the firing of the red warning lamp of the before switching on of automatic machine Av_7 "fans" it is possible + judge which automatic machines are included and which disconnected.

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The closing supplementary contacts of automatic machines are used in the diagram of the sonic and light signaling which wear/operates in the off position at least of one automatic machine of air blowersvozdukhodvok or the absence of voltage 27 in the rectifier of control. These signals forbid the start of automatic machine Av_{13} "transmitters" without preliminary blowout or in the absence of voltage 27 in the rectifier of control.

Upon the start of automatic machine Av_{13}, three-phase current is supplied to the cabinets of P-20D, P-20A, P-200M, NPO, NPU, kA and PPI.

Schematic diagram (Fig. 149). The diagram of signaling

prevent/warns about the following abnormal and emergency modes in the diagram of the feed:

the incorrect order of the alternation of the phases of current with voltage 208 v and frequency 400 Hz;

the noninclusion of one or several blowers;

there is no voltage 27 v on the output/yield of the rectifier of control;

is absent one of the three phases of current with voltage 208 v and frequency 400 Hz.

In composition the diagrams enter phase indicator, the relay of signaling, siren, bimetallic strip relay R_8, relay R_7 and the warning lamps of LN_1, LN_2, LN_{12}-LN_{17}.

phase indicator consists of the incandescent lampnes of LN_1, LN_2, resistor/resistances R_3, R_4, R_5 and of capacitor C_1. To tube LN_2 "dimly" through resistor/resistance R_3 and capacitor C_1 is supplied the line voltage between the first and second phases, while to tube LN_1 "vividly" through capacitor C_1 and resistor/resistances R_4, R_5 is supplied the line voltage between the second and third phases of mains.

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Capacitor C_1 creates the shift of the voltage of the second phase; therefore line voltage on one tube more than on another. If the brightness of the combustion of tube corresponds to chart under them, then the alternation of the phases of power line is correct. The nonconformity of the brightness of the combustion of tubes to chart indicates the malfunction in the mains: is erroneously connected the cable of feed, there is no feed of one of the phases.

With the disturbance of the order of the alternation of phases, wear/operates also supplementary sound communication by red color. For this purpose in parallel to the foot of LN_2 to

resistor/resistance R_3 is connected the circuit, which consists of rectifier D_5, relays R_4 and resistor/resistances R_1, R_2. Relay R_4 is controlled so that it wear/operates only during the short circuit of capacitor C_1 or the incorrect alternation of the phases when tube LN_2 with index "dimly" burns vividly.

The diagram of signaling makes it possible to determine cut-of-order phase of the network of alternating current with voltage 208 v and frequency 400 Hz with switched off automatic machine Av_1 "obshchiy - Set'", using the following table:

Key: (1). Sonic and indicating lights. (2). Indices of phase indicator. (3). Malfunctions. (4). It is dim. (5). Vividly. (6). There is. (7). The cable of feed to input panel is connected erroneously. (8). No. (9). It goes out. (10). There is no first phase. (11). There is no second phase. (12). There is no third phase.

The triggering of relay R_4, which includes sound signal and the blinking warning lamp, is conducted in the absence of control voltage 27 in and by the disconnection/cutoff of any of the automatic machines Av_8-A_{12} including blowers. Consequently, if there is no voltage 27 into or the engine of any blower works in unusual mode/conditions (short circuit, overloading) by which is disconnected the corresponding automatic machine, then the relay R_7 is not disconnect/turned off, the breaking contact of relay R_7 shunted capacitor C_1 the diagram of phase indicator. This leads to an increase in the tension on tube with index "dimly" and the function of relay R_4, the start of siren-howler and the blinking of the warning lamp of the LN_3 of emergency mode.

Work of the diagram of signaling is connected with the blocking contacts of BK_1 and BK_2, established/installed in the section of the location of the automatic machines of blowers. With the closed door

of this section, the contacts of BK_1 are locked, and the contacts of BK_2 are extended. With the open door, on the contrary, the contacts of BK_1 are extended, and contacts Bk_2 are locked. Therefore relay R_4 can wear/operate only with the closed door of the section of the automatic machines of blowers.

During the function of relay R_4 direct/constant voltage from the storage battery/accumulator of illumination through the safety device/fuse PR_7 and the contacts of relay R_4 approaches the siren-howler, also, through the thermorelay R_8 to warning lamp LN_3 with red light filter. Relay R_3 has the composite plate which, being bent during heating, breaks the circuit of feed of the tube of LN_3, producing its blinking.

Resistor/resistance R_{13} and R_{14}, connected in parallel to tube LN_3, increase load on relay R_8 and serve for the selection of the frequency of blinking and brightness of the combustion of tube.

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With the open door of the automatic machines of blowers, the blocking contact Bk_2 is closed; therefore in flickering lamp the LN_3 of emergency mode, is supplied tension from storage battery/accumulator, and relay R_4 and sound signal are disconnected. This is made in order that it was possible to remove the malfunction with the open door without sound signal.

Tension on siren- howler can be supplied, besides relay R_4. With the disconnection/cutoff of high voltage on the working transmitters of P20A P-20D, wear/operates the relay R_6 in the control unit of high-voltage rectifier 11 kV, through contacts of which is supplied voltage on the howler. In this case the blinker signal is absent.

Charger is intended for the charging of the storage batteries, which ensure the radio station traffic of RSIU-4 and the feed of the circuits of emergency light in the absence of the voltage of alternating current. Each battery consists of five acid storage battery/accumulators ZSTP-98D, been connected in series. For obtaining nominal voltages 27 into two jars of one storage battery/accumulator are disconnected.

The storage battery No 1 "AKK R/s" is utilized for a feed during 2-3 h the converter of P-500 for the radio station of RSIU-4. The storage battery No 2 battery lighting" is intended for the feed of the horn circuits, of emergency light, light enclosure and repair baffle/socket. If necessary for switching the storage battery No 1 for the feed of the light circuits or storage battery No 2 for the feed of the converter of PO-500, it is necessary to move end/leads in the cabinet of feed on terminals 11, 12, which have for this target/purpose of nut the "fleecy cloud/wing nuts".

The charger of the cabinet of feed consists of single-phase selenium rectifier D_1 with transformer Tr_1. The current of charge is regulated by a change in the voltage on the primary winding of transformer Tr_1 with the aid of autotransformer Tr_5 (see Fig. 149). Upon the start of switch V_4, the current with voltage 208 v and frequency 400 Hz is supplied to autotransformer Tr_5 and rectifier D_2, the relays R_1, P_2 and R_3, through contacts of which are connected up the storage battery/accumulators to rectifier for a charging.

The start of storage battery to the charge of relay eliminates the possibility of its discharge through the selenium rectifier in the absence of the voltage of alternating current.

The successive start of these relays is conducted by switch V_3 "start to charge". During the setting up of switch V_3 at position "AKK R/s" the voltage on the coil of relay R_1 enters through the blocking contacts, established/installed in the diagram of the launching/starting of the converter of PO-500, protecting thereby the engine of this converter from the inadmissibly high voltage which it is possible with the charge of storage battery. Blocking contacts protect also rectifier itself from overloadings. Upon the start of the converter of PO-500, the block contacts are broken, de-energizing the coil of relay R_1, and rectifier is disconnected from storage battery.

During the setting up of switch V_3 at position "Battery lighting" the voltage on the winding of relay R_2 enters through the circuit closing contacts of the relay of illumination R_5. In the absence of line voltage or blowing Pr_2, the relay of illumination R_5 and R_6 are de-energized, changing over the feed of the diagram of illumination from storage battery, and simultaneously, breaking the feed circuit of relay R_2, they disconnect charger from storage battery.

In the position of "VN. AKK" it is possible to charge the storage battery of the auto or any other, the current of charge which does not exceed 20 a with nominal voltage not above 40 in. It is necessary to keep in mind that in value direct current with voltage 27 in, the rectifier of charger, the storage batteries of the radio station of RSIU-1 and illumination is grounded "minus", but in the storage battery of auto - "plus". Therefore with the charge of the storage battery of auto, it is necessary compulsorily to disconnect both end/leads and to connect storage batteries with the aid of special wires.

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Ammeter IP_2 and voltmeter IP_3 with switch V_2 serve for a monitoring of work of charger. Feed from the storage batteries of "Battery lighting" and and "AKK. r/s" is supplied respectively through automatic machines Av_5, Av_6 with heat shield on 50 a which in work must be always included.

Constructions. The cabinet of feed consists of the section of rectifiers, section of operational automatic machines, switches and of reference instruments, section of nonoperational automatic machines.

For ease of handling, the controls and monitoring are divided into operational and nonoperational. All the operational controls and monitoring are derived on front/leading panel, but nonoperational are placed after being open/disclosed front/leading panel and small doors the section of the automatic machines of blowers.

On the front/leading panel of the middle part of the cabinet,

are placed:

instruments and the indicators, which control the parameters of network - the tube of LN_1 and LN_2 of the diagram of phase indicator, voltmeter IP_1 on 250 v with switch and frequency meter;

the handle of three fundamental automatic machines Av_1, Av_7 and Av_{13}, which ensure the determined sequence of the start of electric power supply. Upon the start of automatic machine Av_1, "common - network" is supplied feed to all auxiliary loads, the cabinet of roll control of azimuth antenna, the cabinet of the radio station of RSIU-4 and automatic machine Av_7. Upon the start of automatic machine Av_7 "fans" enters the feed to the automatic machines of the fans of blowout and the contacts of automatic machine Av_{13}, through which is supplied the feed to all the remaining cabinets of electronic equipment;

the controls and monitoring of work of the rectifier of storage batteries are an ammeter IP_2, voltmeter IP_3 with switch V_3, switch "start to charge", the adjustment knob of the current strength of charge;

the knob/button of the automatic machines of the start of the supplementary blowout of rear wall Av_{14}, of the ventilation of body Av_2 and of fireplace Av_3;

tube (6 pcs.) with red light filters, that signal about the start of the centralized blowout of front/leading and rear walls, local blowout of the tubes of transmitters P-20 and of P-200M and the star. of the rectifier of control;

warning lamp of emergency mode with the red light filter:

safety device/fuses with warning lamps - Pr_2 to 3 a in the circuit of the transformer of illumination Tr_2, Pr_{11} to 5 a in circuit 208 in, 400 Hz, feeds of baffle/socket Pr_1 on 5 a in circuit 208 into 400 Hz, feeds of rectifier Pr_6 to 0.25 a in value 208 in, 400 Hz of the transformer of illumination, Pr_4 to 5 a in value emergency light, Pr_5 on 5 a in the light circuit of body;

knob/button for a conditional signaling into the cabin of driver and the van of power plant.

In the upper section of the cabinet of feed after little doors, are placed the automatic machines Av_8-Av_{11} the fans of blowers and automatic machine Av_{12} the start of the rectifier of control.

After front/leading panel in the middle part of the cabinet of feed, are arranged automatic machine Av_5 the starts of illumination from storage batteries, automatic machine Av_6, the starts of the feed of the radio station of RSIU-4 from storage battery, the switch V_5, which releases the illumination of body, the ringing of the diagram of signaling, safety device/fuses Pr_8 on 20 in, Pr_9, Pr_{10} to 10 a in the low-voltage circuits of the rectifier of control and safety device/fuses Pr_3, Pr_7 on 10 a respectively in the circuits of light protection and signaling.

Fig. 150. Schematic diagram of the fireplace of fan.

Key: (1). Fan. (2). Heater. (3). in. (4). kW.

Systems of heating, cooling and ventilation.

Portable movable three-phase chimney fan is utilized as fan or heater by power 2.5 or 8 kW (Fig. 150). The mode switch of work chimney fan is conducted by switch V_1, whereupon the feed of the electric motor of fireplace is conducted independent of the position of this switch. Therefore if fireplace-fan is connected to coupling Sh_1, then upon the start of automatic machine Av_3 "Electric fireplace" supply voltage will be given on electric motor. During the setting up of switch V_1 in position "fan" the fireplace-fan works as usual fan with productivity of approximately 800 m^3/h.

During the setting up of switch V_1 at position "heater 2.5 kW" the spirals of heating element are connected by "star" and are connected up in parallel to the winding of electric motor. In this mode/conditions of heater fan, it is utilized for the prolonged warm-up of body with the inoperative radio beacon. In position "heater 8 kW" the diagram differs only in terms of fact that the spirals of heating element are connected by "triangle". in this mode/conditions the fireplace-fan is recommended to include for a period not more than 45 min for the warm-up of equipment.

When using a fireplace-fan for the drying of the equipment before starting/launching, hot air flow is headed the intake openings of the system of the blowers of the blowout of equipment. For the drying of cabinets, which are located of front/leading wall, the fireplace-fan is establish/installed to the cabinet of the transmitter of P-200M. For the drying of the cabinets, arrange/located of rear wall, it are establish/installed to cabinet the PPI or to the cabinet of the radio station of RSIU-4, in this case the oscillograph from cabinet is remove/taken.

Sometimes at low temperatures the automatic machines of the cabinet of feed can not be included. In this case fireplace-fan they connect directly to the terminals of the panel of cable inlet with the aid of special cable. Work of automatic machines is restored after warm-up by their flow of hot air.

The cooling system of equipment for radio beacon is accepted air, supply, forced. Entire outfit from the viewpoint of the conditions of blowout is subdivided into two forms. The first form includes the most powerful oscillator tubes of GI-7B and GI-14B,

established/installed in the transmitters of P-200M, P-20A and P-20D. To the second form are related the units with the large amount of tubes, resistor/resistances and selenium rectifiers with by comparatively large for this cooling surface scattered heat output.

The first form of equipment is cooled by the system of the local blowout, and the second - by the system of the centralized blowout.

Cabinet with blowers is made from corner steel, sheathed by sheet iron plates. From within cabinet is upholstered with felt with a thickness 10 mm for the absorption of noise in work of blowers. Cabinet heels to the front wall of the body above driver's cabin. Besides the air of blowers, in this cabinet is placed the converter PO-500. On cabinet the is mounted the light enclosure of auto.

Key: (1). Driver's cabin. (2). Apparatus cabin. (3). In apparatus. (4). Horn. (5). In driver's cabin. (6). In power plant. (7). In apparatus.

Air filters serve for the purification/cleaning of air intake. Filter is sandwich frame with wire gauze. Cavity is filled up by aluminum rings. Rings are greased by spindle oil.

Ventilation of body. For a decrease in the temperature of air in body, is applied natural and mechanical ventilation.

In certain cases the use of natural ventilation is impossible, for example, with powerful dust or cloudburst with the wind. At the very high temperature of surrounding air one of natural cooling by hatches and doors can prove to be insufficiently. Therefore in auto is applied the powerful exhaust ventilation, which consists of three axial-flow blowers.

Exhaust fan has an electric motor of the type of AOL-02-10 (three-phase asynchronous short-circuited, $P = 120$ W, $U = 200$ in, $f = 400$ Hz, $n = 4500$ r/min). Fan capacity is not less than 1500 m^3/h.

Fans can be included separately or together. For their start it is necessary during the correct combustion of the tubes of phase

indicator on the cabinet of feed to include/connect automatic machine "obshchiy - Set'", and then automatic machine "ventilation of body".

Automatic machine in the cabinet of feed shields from short circuits and overloading not less than two engines of fans. Each engine individually by automatic machine is not shielded.

Upon the start of three fans, their general productivity is equal about 5000 m^3/h. Taking into account the entering the body air from supply blowers whose space is equal approximately 2200 m^3, the free volume of air for the ventilation of body is approximately 2800 m^3/h. The air volume in machine is equal to 8 m^3, i.e., into each minute air is changed about 5 times.

Fig. 152. Schematic diagram of the illumination of radio beacon.

Key: (1). Hz. (2). V from battery room. (3). To the blocking of the charges of the storage batteries. (4). Batteries. (5). Target/purpose. (6). Emergency illumination. (7). Panel of cable inlets. (8). Illumination of panel.

Signaling systems, illumination and light protection.

Sound communication. In the auto of radio beacon, are established/installed two electric bells: in chauffeur's, cabin the bell is supplied from mains 12 in and in apparatus cabin (in the cabinet of feed) from mains 24 in. In the electric station P3S-6, is established/installed siren- howler, feed from mains 24 in. Sonic conditional signaling is realized in the operating position of system - between radio beacon and radio station of P3S-6; in march position - between the radio station of P3S-6 and driver's cabin; in march and operating positions - between the apparatus cabin and the cabin of the driver of the auto of radio beacon.

Figure by 151 solid lines shows coupling cable for a operating position, dash - for march. In operating position is applied cable No 124 brands of NRWM 6 x 2.5 (two vein/strands they are utilized for a telephone communication) 25 m long. Cable connects itself to the terminals of 4-7 panel of the cable inlets of radio beacon and radio station of P3S-6.

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In march position is applied the cable of the brand of RPW 1.5 x 4 by length 3 m. Cable connects itself to terminals 3, 5, 8 coupling couplings (plugs), arrange/located in the auto of radio beacon (tractor).

For the agreement of the feed of bells and siren-howler from the different in voltage storage batteries of radio beacon and radio station of the P3S-6, which work by single-wire diagram with the different polarity of grounding, serve two extinguishing resistor/resistances on 200 ohms. Safety device/fuse Pr, on 10a and the knob/buttons of signaling are established/installed in the cabinet of feed.

The illumination and the light protection of radio beacon are supplied by voltage 27 in alternating current in the presence of mains 208 in, 400 Hz. In the absence of mains, the light protection and part of the illumination automatically convert themselves into feed from the storage battery No 2. The tube of emergency light and sconce they have their own switches and they can be disconnected for

the savings of the energy of storage battery. All switches of light protection (auto itself, extension point/item, the antenna of the radio station of RSIU-4, the illumination of azimuth antenna) are removed to the panel of cable inlets for the start of illumination with closed auto (Fig. 152).

The switches of three tubes in body are arranged on input door. Tube, which is located above the cabinet PPI, which is closed by shutter, has its switch in operator. On door there is a blocking is provided also switch V_5 the releasing blocking of door.

Tube of illumination, light protection, illumination of azimuth antenna and panel of cable inlets - double-contact, aircraft, on 27 in. Whole light protection is made by two in parallel connected tubes with a power on 25 W. Body is illuminated five with lamp/canopies and one sconce. In each ceiling and sconce, are establishe./installed the tubes from 15 W.

The neadlight of the illumination of territory (with tube 25 W) can be established/installed in special clamp to the right or to the left of auto. Headlight is established/installed on hinge for

rotation in any direction. During the setting up of headlight to the right it is included in the baffle/socket of the panel of the cable inlets, during setting up to the left - into the baffle/socket, established/installed on rear wall of actuating motor next to coupling for a fireplace-fan. Coupling and baffle/socket are closed by the easily being open/disclosed jackets. In three ceiling lamp/canopies are established/installed the tubes from 5 W.

end section.

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INSTALLED EQUIPMENT OF SYSTEM RSBN-2.

Installed equipment of system RSBN-2 works together with ground-based radio beacons and serves for the solution of a series of navigational problems in all stages of flight. Onboard equipment is comparatively complex both according to the operating principle and on its design. In its composition it enters more than 15 units.

In view of the fact that installed equipment solves the wide circle of the navigational problems, different by nature, is provided several mode/conditions of its work. Fundamental of them it is possible to consider mode/conditions "navigation" and mode/conditions "landing/fitting". Furthermore, is one additional supplementary mode/conditions "cloud penetration", which can be included simultaneously with any of the fundamental.

Mode/conditions "navigation" in turn, is subdivided into six partial mode/conditions which conditionally are called: "KPP [99sp4 - flight director] is switched off", "azimuth to", "azimuth from", "orbit left", "orbit right" < "computer."

Mode/conditions "landing/fitting" is subdivided into landing/fitting on the beacons of the system of "SP-50" and landing/fitting on decimeter beacons of the type "leg".

The necessary operating mode of instrumentation is selected with

the aid of the appropriate switches.

Navigations. Installed equipment works with the ground-based radio beacon of system RSBN-2. The location of this radio beacon is accurately noted on flight map/chart. Is known also the number it dripped communication/connections, on which works this radio beacon, and the azimuth of the aaaa of aircraft relative to this same radio beacon. Arrange/locating these data, aircrew at any point in time can determine the position of aircraft on map/chart and, therefore, produce all the necessary navigational calculations.

The fundamental problem of the navigation of flight vehicles is the recovery from one point of space into another on specified track in preset time.

It is possible to visualize the following diverse variants of the flight of aircraft from point/item A into point/item into relatively ground-based radio beacon (Fig. 153).

1. On straight line, passing through the point in which is

arranged ground-based radio beacon.

2. On "orbit", i.e., on the circular arc of assigned radius R_3 whose center coincides with the point of the location of ground-based radio beacon.

3. On any straight line, not passing through the point of the location of ground-based radio beacon.

In the first case, as can be seen from Fig. 153, if the aircraft moves over specified track (Assigned Track Line), then its current azimuth of aaaa always remains constant and equal to the assigned azimuth of aaaaa i.e. is fulfilled the condition:

During the deflection of aircraft from Assigned Track Line, this condition is disrupted.

In flight for "orbit" the condition of the determination of aircraft on Assigned Track Line is determined by the equation:

Let us examine the conditions which make it possible to judge, does move the aircraft not of Assigned Track Line, with that not passing through the ground-based radio beacon, or it was deflectted from it (Fig. 154).

Fig. 153. Diagrams of recovery into the assigned point/item.

Fig. 154. Geometric treatment of the objective, accomplished by computer.

In point o, is arranged the radio beacon. The line after of this path is determined by track angle (- angle, counted off clockwise, between the northern direction of meridian and Assigned Track Line) and by coordinates of the assigned point/item v (aaaa and aaaa). The coordinates of aircraft always change and are equal aaaa and aaaa.

Let at certain point in time the aircraft be deflectted from Assigned Track Line and is located in point A' to conduct line, parallel Assigned Track Line, but from point o to drop perpendicular on Assigned Track Line, then will be obtained two right triangles of OA'S' and OVS.

From the triangle of OA'S', let us find:

while from the triangle of the OVS:

where β and γ -- auxiliary angles.

Lateral deflection of aircraft from Assigned Track Line

If aircraft is found on Assigned Track Line, then deflection SS' = 0 and equation assumes the form

Auxiliary angles β and γ it is easy to express by the known navigational values of aaaaaaa and aaaa. Figure 154 shows that

By substituting equation (5) in equation (4), we will obtain

Analogously we find

By substituting equations (6) and (7) in equation (3), we will obtain

Equations (1), (2) and (8) play role during air navigation, since, by utilizing them, it is possible to create the convenient position display of aircraft relative to Assigned Track Line.

To the pilot, who directly realizes the aircraft control, it is inconvenient to use readings of the indicator of the type PPDA, since in this case, in order to pilot according to Assigned Track Line, for it it is necessary to compare readings with the rated values of azimuth and range. This it distracts from observation of readings of other instruments and largely complicates work.

For the facilitation of pilot's work in the composition of installed equipment, are included the computers, which depending on the selected operating mode solve one of that which were given

equation (1), (2) or (8) and issue direct/constant voltage, proportional to the amount of deflection of aircraft from Assigned Track Line.

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Fig. 155. Indication of the location of aircraft relative to Assigned Track Line with the aid of KPP.

The polarity of voltage depends on the side of the deflection of aircraft from Assigned Track Line. This voltage is supplied to the course system of the bullet-instrument of the combined flight instrument (KPP). If aircraft is found on Assigned Track Line, then course (vertical) the rifleman/gunner of KPP is located in the center of the scale (within the limits of black small circle), during the deflection of aircraft from Assigned Track Line deviates KPP'S vertical arrow/pointer, indicating, to which side it is necessary to turn aircraft in order to return on Assigned Track Line (Fig. 155).

Thus, in the presence SRP with output/yield to null indicator to pilot in order to pilot according to Assigned Track Line, sufficient to control the position of the vertical arrow/pointer of KPP and, maneuvering with aircraft, to hold it in the center of the small circle of dial face. This to a considerable degree simplifies the process of air navigation.

Simultaneously there is a possibility to signal the crew of aircraft about approach/approximation to the assigned point/item and its flight/span.

In flight in any of that which were indicated above of three methods to the given point with approach/approximation toward it, the value of a difference in the aaaaaaa and aaaaaaaa gradually decreases also at that torque/moment when aircraft is located in the assigned point, are fulfilled simultaneously two equalities:

This circumstance it makes it possible to carry out a signaling pointed out above. For this, in apparatus is a device, which converts the value of difference in equations (1) and (2) into voltages. They are supplied to actuating element.

During the approach/approximation of aircraft to the assigned point/item up to the distance, which corresponds 1-2 min of flight, are satisfied the conditions:

where the aaaaa and ΔR - the assigned boundary values.

In this case, the voltages, which enter the actuating element, become the less assigned threshold value and actuating element it switches on green warning lamp. With the flight/span of the target/purpose when is satisfied condition (9) and both voltages they become equal to zero, short-term included red signal light. The warning lamps are arrange/located on the instrument panel of pilot and are duplicated on the instrument panel of navigator.

If we after the switching on of green warning lamp press knob/button "readiness", then at the torque/moment of the flight/span of target/purpose wear/operates the circuit of execution which is intended for the dropping of loads from aircraft.

Thus, in mode/conditions "navigation" is possible the solution of the following problems.

1. Position finding of aircraft.

2. Drive of aircraft to the given point (with the indication of the torque/moment of approach to this point and of the torque/moment of its flight/span): on straight line, passing through the point of the location of ground-based radio beacon, on the orbit, on any straight line, not passing through the point of the location of ground-based radio beacon.

Landing/fitting. For providing instrument/tool landing, there is special landing instrumentation of airfields. It makes it possible to make landing/fitting at night also, under severe weather conditions in the absence of ground visibility. Most widely accepted are at present the heading-slope landing systems in which for the creation of glide path are utilized course and glide beacons.

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Glide-slope descent begins approximately 15 km of the beginning of take-off-landing band (runways) from height/altitude on the order of 700 m and concludes at beginning runways. Concluding ethane of landing/fitting is conducted, as a rule, it is visual on lighting equipment.

The majority of commercial fields is equipped with landing system SP-50 (in the modernized version - SP-50M). Are recently developed and undergo test decimeter course and glide beacons of the type "leg". Installed equipment RSBI 2s in mode/conditions "landing/fitting" can work with beacons of the type "leg", and in the presence aboard of glide slope receivers - and with the beacons of system SP-50.

In system SP-50, the plane of course is assigned by the localizer beacon of KRM-2. Its signals are received aboard as course radio receiver (KRP). After processing signal in receiver at its

output/yield, is obtained direct/constant voltage whose value and polarity depend on value and side of deflection from the plane of course. This voltage is supplied to the course system of zero-adjustment instrument. Furthermore, in the receiver of KRP is developed the signal, which testifies to the soundness of entire circuit, localizer beacon - course radio receiver. This signal approaches the blinker of the trouble signaling of the course channel of the zero-adjustment instrument which in this case is closed, which attests to the fact that equipment is exact and readings of zero-adjustment instrument can be utilized during the fulfillment of landing approach.

The plane of decrease in system SP-50 is assigned by the glide-path beacon of GRM-2. Its signals are received aboard as glide radio receiver (GRP (99sp7 - glide-path radio receiver)), which after their processing, just as receiver KRP, issues two voltage. one of them contains the information about the position of aircraft relative to the plane of decrease and is utilized for the feed of the glide (horizontally deflecting) system of zero-adjustment instrument, but the second approaches the emergency blinker of glide channel.

Thus, in order to ensure a decrease in the aircraft on glide

path, pilot must, maneuvering with aircraft, maintain/withstand the course and glide arrow/pointers of zero-adjustment instrument in the center of the scale. In this case the aircraft with landing approach will be simultaneously located also in the plane of course and in the plane of decrease, i.e. it will descend on line to their intersection glide path.

In the work of installed equipment in mode/conditions "landing/fitting on SP-50" aboard must be located the receivers of KRP and GRP. During the setting up of toggle switch the "arch/summary - SP-50" at the position of "SP-50" the output/yields of these receivers with the aid of coupling unit with SP-50 are connected to KPP'S instruments.

In mode/conditions "landing/fitting on SP-50" from entire installed equipment are utilized the only null indicators of KPP which are disconnected from system RSBN 2s and are connected to glide slope receivers.

A landing system of the type "leg" also includes course and glide-path beacons. They work in the decimeter range of radio waves.

Each them of them depending on the selected communication channel of communication works on one of the forty record/fixed frequencies. The record/fixed frequencies KRM coincide with the frequencies of azimuth channel, while the record/fixed frequencies GRM - with the frequencies of the ranging channel of the ground-based radio beacon of system RSBN-2. Therefore the reception of their signals aboard is provided with receiver SPAD. During the translation/conversion of system RSBN 2s into mode/conditions "landing/fitting" in work are included the cascade/stages of information processing, included in signals KRM and GRM.

Operating principle KRM of the type "leg" entails the following. Its antenna system creates in horizontal plane the radiation pattern, which has the form of two intersecting lobes which are form/shaped in turn. The frequency of the commutation of lobes is equal to 13 Hz. The high-frequency signal of the first lug/lobe is modulated by frequency 1300 Hz, the second - by frequency 2100 Hz. The equisignal line, formed as a result of the intersection of lobes in horizontal plane, is combined with the course line of landing/fitting.

In onboard equipment after detection of high-frequency oscillations, the signals 1300 and 2100 Hz frequency are divided with

filters, they are straighten/rectified and are compared between themselves. The value of difference voltage is determined by the degree of deviation of aircraft from course line. This voltage is supplied to the deflection system of the vertical arrow/pointer of KPP'S instrument. The summed current of both rectifiers powers the blinker of trouble signaling.

Fig. 156. Diagram of decrease along the predetermined trajectory and the position of KPP'S arrow/pointer.

Glide-path beacon and glide channel of onboard equipment they work analogously, with the exception of the fact that antenna system of ground-based radio beacon creates radiation pattern in the form of two intersecting lobes, arrange/located in vertical plane, while the glide channel of onboard equipment works on the deflection system of horizontal arrow/pointer and the blinker of the trouble signaling of the glide channel of KPP'S instrument.

Cloud penetration. Entire process of instrument landing can be broken into two stages: cloud penetration (tbd), i.e., decrease from high altitude to height/altitude approximately 700 m glide-slope descent, created to KRM and GRM, to height/altitude 30-60 m.

Cloud penetration can be conducted in direction in ground-based radio beacon in any selected azimuth or in the direction on of landing pattern with the help of KRM. Therefore on-board outfit must make it possible to involve mode/conditions "tbd" both together with the mode/conditions "navigation" and with mode/conditions "landing/fitting". The form of the curve po in the general case is determined by the aerodynamic properties of aircraft and by the special feature/peculiarities of its use. On the strength of this the lines po of the aircraft of different types have different

slope/inclination to the horizon and can take the form of broken line. The beginning of process tbd can be produced from height/altitude 10.000 m and range 240 km.

If is known the farm/truss of the curve of tbd, then it can be written as function of base altitude of the range:

Since BD it issues the measured range to ground-based radio beacon in the form of the angle of rotation of measuring axes, with one of such axes (250 km) is connected functional potentiometer. Angle α its rotation is proportional to range to ground-based radio beacon. Potentiometer is made in such a way that the removed from it voltage would reflect functional dependence (11), which for different aircraft types was different, i.e., in order that this voltage would be to the proportionally base altitude for this range. It is compared with the voltage, proportional to the current aircraft altitude at the given instant which is remove/taken from the altitude sensor of DV-47.

The obtained difference in these voltages characterizes value and the side of the deflection of aircraft from trajectory po (Fig. 156). By differential voltage is powered the deflection system of KPP'S horizontal arrow/pointer, and to the blinker of KPP'S glide channel with BD is supplied the voltage, which testifies to normal operation BD. Consequently, for the fulfillment of decrease on curve on pilot must, maneuvering with aircraft in vertical plane, hold horizontal arrow/pointer KPP in the center of the scale.

If cloud penetration occurs on the localizer beacon of landing system, then in the beginning runways must be established/installed the landing repeater of the range finder to which in this case on aircraft is measured the range.

Upon the simultaneous start of two mode/conditions "tbd" and the "landing/fitting" at a distance 15 km of beginning runways is provided the automatic changeover of the glide channel of zero-adjustment instrument from mode/conditions "tbd" in mode/conditions "landing/fitting". Further decrease occurs on the

glide path, created by glide landing beacon. The torque/moment of switching to work with glide-path beacon is noted by the start of warning lamp "Radioglissada is included", arrange/located on instrument panel.

Functional diagram. All cell/elements of the diagram of the system RSBN 2s are grouped in separate unit, each of which fulfills the determined function. The work of instrumentation as a whole is determined by the consistent use of those or others of these units in different combinations. Starting of the necessary units, i.e., the selection of operating mode, is conducted by the function selector (PRR) and by the corresponding toggle switches.

Fig. 157. Simplified functional diagram of system RSBN 2s.

Key: (1). Knob/button is "Opaznavaniye". (2). Functional potentiometer. (3). Altitude sensor. (4). Landing receiver. (5). Toggle switch. (6). Interrogation. (7). Unit. (8). Selector of orbit. (9). Relay assembly. (10). Unit of communication. (11). Toggle switch is the arch/summary. (12). Control. (13). Commutator switch of communication. (14). Demand ground-based IKD. (15). Answer/response of retrapslatora. (16). Directly readout instrument, PPDA. (17). Control. (18). Unit. (19). Selector of azimuth. (20). Unit of performance. (21). Course system. (22). [illegible]. (23). Channel of landing/fitting. (24). Point/item. (25). Approach.

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Fig. 158. Aircraft interrogator of range.

Fig. 159. Aircraft receiver SPAD-2.

The shown in Fig. 157 diagram serves for the explanation of the principle of the work of system RSBP 2s, but not always reflect its division into structural units.

The inquisitor of range (Fig. 158) serves for a formation and emission/radiation through the transmitting antenna in direction "aircraft" - the earth/ground": the inquiring signals of aircraft radio distance gauge, response signals ground-based PPI, the signals of the individual identification of aircraft on ground-based PPI.

This transmitter has two input. It operates on a pulsed basis and emits signals only after admission to its inputs of trigger pulses. During starting/launching on the first input, is emitted the two-pulse coded signal (demand of aircraft range finder). On this input the trigger pulses enter with hp.

During starting/launching on the second input, is emitted the three-pulse coded signal (answer/response to ground-based PPI). On the second input the trigger pulses enter from the output/yield of the decoder of the ranging channel of receiver.

With the pressed knob/button "identification" aboard the aircraft each three-pulse response signal to ground-based PPI is emitted 2 times with interval 30-60 μss. As a result of this, the mark of this aircraft on ground-based PPI is obtained that which was doubled.

Transmitter has four dialing/set of different codes. Each dialing/set contains one two-pulse (for inquiring signals) and one three-pulse code (for response signals).

A transmitter it has 10 frequency channels, stabilized by quartz. The presence of four dialing/sets of codes and ten frequency channels makes it possible to obtain 40 channels of communication/connection aircraft-earth/ground". The selection of the necessary communication channel of communication is conducted by the switch, arrange/located on control panel.

Aircraft receiver SPAD-2 (Fig. 159) serves for the reception: response signals to aircraft range finder; the inquiring signals of

ground-based PPI; reference signals "35" and "36"; azimuth signals; the signals of decimeter course localizer beacon; the signals of decimeter glide localizer beacon; furthermore, in the composition of receiver, are included the diagrams of processing the taken signals; the decoder of the response signals of range; the decoder of inquiring signals PPI; the decoder of reference signals "35"; the decoder of reference signals "36"; the shaping unit of azimuth momentum/impulse/pulse (Payes); the unit of landing/fitting; the assembly of the filters of course channel; the assembly of the filters of glide channel.

In dependence from the structure of those entering the input of sensing transducer and from the operating mode of onboard equipment the signals from the load of detector receiver approach these or other of these diagrams.

Fig. 160. Measuring unit of range.

Receiver works on one of the 10 frequency communication channels of communication. The selection of the channel of communication/connection is conducted by the switches, arrange/located on control panel which simultaneously control switching the communication channels of communication, also, in the receiver of SPAD-2 and in transmitter SZD.

Receiver simultaneously picks up signal of the ranging and azimuth channels which differ from each other in frequency to one and the same the value:

where the aaaa are carrier frequency of the ranging signals of aaaa - the frequency of azimuth signals.

The input circuit of receiver (mixer and heterodyne) they are overall cell/elements for the signals of both channels. On the load of mixer, are obtained two voltages of different intermediate

frequencies

where the aaaaaa - the intermediate frequency of ranging channel; aaaaaa are an intermediate frequency of azimuth channel; aaaa - the frequency of heterodyne.

The signals of intermediate frequencies subsequently are divided and are amplified in two different channels: the IF amplifier of azimuth (UPC-AK) and the IF amplifier of range (UPC-DK).

Each of the indicated channels concludes with detector. In the work of installed equipment in mode/conditions "navigation" the signals from the output/yield of ranging channel approach: the decoder of response signals, from which reciprocal momentum/impulse/pulses are supplied in BD; the decoder of the inquiring signals of the ground-based radio beacon from which interrogation pulses (through the coincidence circuit) they are

supplied to starting/launching SZD on the second input.

From the output/yield of azimuth signal channel, approach: the decoder of reference pulses "35"; the decoder of reference pulses "36"; the shaping unit of azimuth momentum/impulse/pulses.

From the output/yields of these devices, the obtained momentum/impulse/pulses are supplied to

In the work of installed equipment in mode/conditions "landing/fitting" voltage from output/yield of UPC-DK and the UPC-AK are amplified in two independent channels each of which concludes with the unit of filters.

Signal from UPC-DK is amplified in the unit of landing/fitting, while signal from UPC-AK - in the unit the Fayes in which in mode/conditions "landing/fitting" is utilized the only video amplifier (from remaining cascade/stages with the aid of relay is remove/taken anode voltage).

In mode/conditions "landing/fitting" simultaneously with signals GRM is realized reception and processing the signals of the ranging channel of ground-based radio beacon. Because of this the ranging circuit normally works in mcde/conditions "landing/fitting", which makes it possible to make cloud penetration, measuring aboard the aircraft the range prior to beginning runways, where must be established/installed the landing repeater of range finder.

The measuring unit of range (Fig. 160) fulfills the following functions: issues momentum/impulse/pulses for a starting/launching SZD on the first output/yield; automatically measures time interval from the torque/moment of the premise/impulse of interrogation pulse to the torque/moment of the arrival of response signal.

The diagram of unit the data-out on the current range to the ground-based radio beacon: to the counter of the range direct-read instrument of PPDA; into computer; into the diagram of the bullets of driving and indication of the torque/moment of the passage of the assigned point/item; into the diagram of cloud penetration.

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The measurement ranges of range are from 0 to 440 km. Accuracy of ranging - 200 m according to the scale of the counter of the range of PPDA.

Ranging is conducted according to principle "interrogation-response". In BD is measured the time of the aaaa of the time lag of reciprocal momentum/impulse/pulse relative to inquiring. This time is connected with the measured slant range by the following relationship/ratio:

where R is slant range aircraft - ground-based radio beacon; c is velocity of propagation of electromagnetic energy in vacuum.

The measurement of the time interval of aaaa is conducted by the compensation method whose essence entails the fact that in BD is form/shaped the measuring (selector) momentum/impulse/pulse, delayed relative to the torque/moment of the premise/impulse of interrogation pulse. The delay factor in the measuring momentum/impulse/pulse of aaaa can change over wide limits and be counted off according to the scale of the counter of the range of the instrument of the PPDA which is enumerated in kilometers. In composition BD the servo system which affects the delay factor in the aaaa and automatically provides the fulfillment of the equality of aaaaaa.

Thus, during the fulfillment of this equality according to the scale of the counter of range is calculated the value of aaaa which is proportional to the measured slant range.

Since one and the same ground-based radio beacon, as a rule, works with many aircraft range finders (to 100) it answers the demands of each of them, to input decay each of the assemblies installed equipment come the reciprocal momentum/impulse/pulses, intended not only to this range finder, but also the so-called

"strangers". In order to ensure the normal process of ranging, are necessary from entire totality of momentum/impulse/pulses, which enter on input decay, to select only those, that are answer/response to the demands of this range finder.

In BD it is provided two operating mode: the mode/conditions of "search" and the mode/conditions of "capture and tracking" (mode/conditions of "tracking").

In the first mode/conditions occurs the search "for its" reciprocal momentum/impulse/pulses, in the second is provided the following after the obtained "their" reciprocal momentum/impulse/pulses and measurement inclined to range. Transition of one mode/conditions in another occurs automatically.

In order to distinguish its "" reciprocal momentum/impulse/pulses of "the strangers", is utilized time selection. "their" reciprocal momentum/impulse/pulses differ from "the strangers" in the following criteria.

first, their repetition frequency is accurately equal to the frequency of the premise/impulse of the interrogation pulses of this range finder. For the facilitation of the process of time selection the repetition frequency of interrogation pulses makes unstable; therefore at each point in time, each range finder has its repetition frequency of interrogation pulses, which differs from the repetition frequency of the interrogation pulses of other range finders;

in the second place, the temporary situation of "strange" reciprocal momentum/impulse/pulses relative to the torque/moment of the emission/radiation of interrogation pulse unstably changes from one demand to another according to random law. For its "" reciprocal momentum/impulse/pulses the time lag is determined by slant range to ground-based radio beacon and either remains constant or it changes very slowly. To show this is possible by simple calculation. Let the velocity of aircraft be equal to 3600 km/h and it flies from radio beacon or to it. Then slant range will change at a rate of 1 km/s. Taking into account that the frequency of the premise/impulse of interrogation pulses in the mode/conditions of "tracking" is equal to

30 Hz, it is possible to calculate, that the temporary situation "of its" reciprocal momentum/impulse/pulses relative to the torque/moment of demand for this time changes approximately on 0.1 μss. Of the principle of time selection it utilizes these two sign/criterion.

Simplified the work of range finder can be presented as follows. At first, when aaaaaaaa reciprocal momentum/impulse/pulse does not coincide with measuring. In this case, BD is located in the mode/conditions of "search" which it is characterized by the fact that the calibrated delay smoothly increases and measuring momentum/impulse/pulse delays relative to inquiring increasingly more and more. Finally, when aaaa will be approximately equally aaaa it will initiate to occur the agreement of reciprocal momentum/impulse/pulses with measuring. If agreement occurs several times in a row (5-10), and this is possible only in such a case, when with measuring momentum/impulse/pulse coincide "their" reciprocal to them pulses, then diagram passes to the mode/conditions of "capture" and "trackings".

Fig. 161. Measuring unit of azimuth.

This mode/conditions is characterized by the fact that ceases change in the value of the calibrated delay and measuring momentum/impulse/pulse it is form/shaped with one and the same delay relative to inquiring, equal aaaa (with constant range). If the temporary situation "of its" reciprocal momentum/impulse/pulse slowly changes, then the servo system provides an appropriate change in the calibrated delay in order that would be retained the register of reciprocal momentum/impulse/pulses with the center of measuring momentum/impulse/pulse.

The alternating/variable calibrated delay is created with the aid of phase inverter and the phantastron, the pulse duration of which is controlled by potentiometer. In the mode/conditions of "capture" and of "tracking" the angles of rotation of the rotor of phase inverter and axis of potentiometer proportional to the measured range. The angle of rotation of axes with the aid of synchronously servo system transmits to the counter of the range of PPDA, in SRP the diagram of zero-driving for the indication of the torque/moment of the passage of the assigned point/item. The axis of the potentiometer of diagram on directly is connected with one of the output axes (250- km).

The measuring unit of azimuth (Fig. 161) serves for the measurement of the current azimuth of aircraft and presentation of information to the directly indicating instrument PPDA, in SRP, into the diagram of zero-driving and indication of the torque/moment of the flight/span of the assigned point/item. The accuracy of the measurement of azimuth is 0.25°.

For the measurement of azimuth on aircraft, are utilized two series of reference pulses "35" and "36" and azimuth momentum/impulse/pulses. At the torque/moment of the coincidence of the axis of the symmetry of the radiation pattern of the azimuth antenna of ground-based radio beacon with northern direction, occurs the agreement of reference pulses. Since the time interval between "northern" agreement and the torque/moment of the reception of azimuth momentum/impulse/pulse is proportional to the azimuth of aircraft, the problem of the azimuth determination of aircraft is reduced to the measurement of this interval. Its measurement is conducted into BIA by compensative method (just as in BD). Into BIA is form/shaped the mobile/motile measuring momentum/impulse/pulse which in the process of measurement is combined with azimuth. The value of the bias of measuring momentum/impulse/pulse relative to "northern" agreement is record/fixed according to the dial faces of PPDA. In composition BIA, enters the servo system, which,

automatically changing a time delay in the measuring pulse relative to "northern" agreement, provides its coincidence with azimuth.

The measured azimuth is determined by expression

where the aaaa - the current azimuth; t is a temporary displacement of azimuth momentum/impulse/pulse relative to "northern" agreement; T - the time interval between two northern agreements.

A delay in the measuring momentum/impulse/pulse is created by phase-meter method, in this case the error in the delay in essence is determined by an error in phase inverter (3-5°). This accuracy is very low. For its increase is utilized the precise channel, in which as supporting/reference markers are accepted ten-degree momentum/impulse/pulses (reference pulses "36").

Thus, the process of the measurement of azimuth falls into two stages; the search for the ten-degree interval in which is located azimuthal momentum/impulse/pulse; the determination of the temporary situation of azimuth momentum/impulse/pulse within the limits of

ten-degree interval.

The second operation is made by the cell/elements of a precise channel. In this case, the accuracy of azimuth determination considerably grow/rises.

Fig. 162. Directly indicating instrument of range and navigator's azimuth.

Fig. 163. Control panel of navigator.

An increase in the accuracy occurs as follows.

The rotation of the phase inverter of rough channel through 360° causes the bias of measuring momentum/impulse/pulse from one "northern" agreement up to another, which corresponds 360° azimuth. The error of phase inverter into 3-5° causes accurately the same error in azimuth determination.

The rotation of the phase inverter of a precise channel through 360° causes the bias of measuring momentum/impulse/pulse from one ten-degree marker up to the adjacent, i.e., on 10°. An error in the phase inverter of a precise channel is also equal to 3-5°, i.e., 1/120-1/72 part of entire ten-degree interval, or 1/12-1/7 degree of azimuth. Taking into account other sources of errors, the accuracy of the work of azimuth channel is determined by value 0.25°.

Transition from the mode/conditions of the "search" for ten-degree interval to the mode/conditions of the precision measurement of azimuth occurs automatically. The result of measurement is issued in the form of the angle of rotation of the axes of rough and precise phase inverters. With these axes are

mechanically connected the selsyn transmitters with the aid of which the angle of rotation transmits to the needle bearing indicators of instruments PPDA (to instrument PPDA-P transmits the only result of the rough measurement of azimuth). In the unit of performance and into the diagram of prevention/warning the value of the current azimuth enters through the selsyn transmission, which works in transformer mode/conditions, while in block SRP - with the aid of the synchronous servo system.

In the composition of the assembly of instrumentation enter two directly indicating instrument: PPDA-P and PPDA-W (Fig. 162). These instruments serve for the continuous and direct/straight indication of azimuth and range of aircraft relative to ground-based radio beacon pilot and navigator.

On the instrument of PPDA-W, the azimuth is counted off according to two scales: rough and precise. The scale of coarse reading has limits of 0-360° with scale value 10°. The scale of fine reading has limits of 0-10° with scale value 0.1°. Instrument PPDA-P has the only rough scale with scale value2°./

range on both instruments it is counted off on four-place counter with accuracy 50 m. The rifleman/gunners of bearing indicator are connected with the measuring axes of BIA with the aid of selsyn transmission. The result of ranging from BD is supplied to the counter of the range of PPDA with the aid of the synchronously servo transmission.

The selector of azimuth and the selector of orbit are arranged on the control panel of navigator (Fig. 163). They serve for the setting up on them of the assigned azimuth of aaaa and designated orbit R_3.

The selector of azimuth contains two receiving synchro (rough and precise channels), that work in transformer mode/conditions, which are connected with the appropriate selsyn transmitters of BIA.

If we on the selector of azimuth establish/install the value of

aaaa that in the process of flight from output/yield selsyn pair (selsyn transmitter - selsyn transformer) along rough and precise channels are issued the voltages the are proportional to the difference of aaaaaaaa which approach the input of the block of performance.

Fig. 164. Assembly of control SRP.

Fig. 165. Assembly of final adjustment SRP.

Fig. 166. Combined flight instrument.

The selector of orbit works analogously, with the exception of thefact that but to rough channel the voltage of mismatching proportional aaaaaaaa is created by the bridge circuit, carried out on the potentiometers one of which is arranged in BD, and by the second - in the selector of orbit. Voltages, proportional differences in the aaaaaaaa also approach the input of the assembly of performance.

The selector of azimuth and the selector of orbit actually are the resolvers which solve equations (1) and (2).

The assembly of performance is structurally arranged together with BD. It provides air navigation on null indicator (KPP) along the assigned azimuth and on the designated orbit, signaling about approach to the assigned point/item and about his flight/span, in this case at will of crew, can be automatically given the signal to device for the dropping of loads.

To the assembly of performance from the selector of azimuth and selector of orbit, enter the error voltages through rough and precise channels. In the assembly of performance it is possible to isolate

two diagrams: one of them provides air navigation on null indicator, and the second - signaling about approach to the assigned point/item and its flight/span. To the first diagram depending on the selected operating mode, is supplied the error signal either from the selector of orbit or from the selector of azimuth. In this diagram occurs the transformation of subject signal into the DC voltage of one polarity or the other, which is utilized for the feed of KPP'S course system.

To the second diagram are supplied the error signals, also, from the selector of azimuth and from the selector of orbit simultaneously. This diagram provides the joint solution of equations (1) and (2) and, when is satisfied condition (10), is issued signal to tube "approach", and during satisfaction of condition (9) - to warning lamp the "point of destination".

Computer serves for delivery on the course system of KPP of the voltage, which characterizes the position of aircraft relative to Assigned Track Line in flight on any straight line, not passing through the point at which is established/installed ground-based radio beacon. Structurally SRP is carried out in the form of two assemblies: the assembly of control SRP (BU SRP, Fig. 164) and the assembly of final adjustment SRP (side-looking SRP, Fig. 165).

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The assembly of control SRP is placed on the work site of navigator. On its front/leading panel are arranged the knob/sticks for water of the coordinates of the assigned point/item of aaaaaaaa and given course angle of aaaa and also the scale according to which it is possible to count off the values of the introduced quantities. Flowing azimuth and range enter SRP from BD and BIA with the aid of the synchronously servo systems.

SRP is the electromechanical resolver which provides the solution to equation (8).

The combined flight instrument (Fig. 166) is bullets the instrument, which has course (vertical arrow/pointer) and glide (horizontal arrow/pointer) systems, course and glide blinkers and the system of the indication of magnetic course.

To the course and glide systems of instrument, are supplied the signals, proportional to the deflection of aircraft from Assigned Track Line in horizontal and vertical planes.

With the aid of KPP is provided the zero-driving of aircraft during the flights: along orbit and azimuth, in this case the course arrow/pointer is controlled from the assembly of performance; on the rectilinear route, not passing through the point of setting ground-based radio beacon, in this case the course arrow/pointer is controlled from the side-looking SRP; on the course of landing/fitting and glide path, in this case course and glide arrow/pointer are controlled by voltages from the output/yields of assembly landing/fittings of receiver decay or by the voltage of functional potentiometer and altitude sensor of DV-47; along trajectory tbd, in this case the glide arrow/pointer is controlled by differential voltages from the output/yields of glide slope receivers.

Magnetic heading is supplied to KPP'S scale from course system with the aid of remote-control servomechanism.

Depending on aircraft type on which is established/installed the system RSBN '2s, it is utilized from one to three KPP.

Relay assembly (BR) in the work of installed equipment in the different mode/conditions of KPP'S null-indicator is connected to the different sections of diagram. Relay assembly is intended for the commutation of the circuits of the course and glide systems of KPP and their indicator circuits. In mode/conditions "landing/fitting" the relay assembly realizes a transfer of control of the landing channels of communication/connection with the control panel of navigator to pilot's panel (this is not reflected in Fig. 157).

The assembly of landing signals is structurally placed in the receiver of SPAD-2. It includes two channel: course and glide.

The operating principle of both channels is identical. Each channel converts the detected signal with respect to KRM or GRM into direct/constant voltage whose value and polarity are determined by

the amplitude ratio of the modulating stresses of frequency 1300 and 2100 Hz.

To the input of course channel, enters the signal from the load of the detector of UPC-AK, while on the input of glide channel - from UPC-DK. The structure of signals KRM and of GRM after detection is identical - they are the sum of low-frequency oscillations 1300 and 2100 Hz. The amplitude ratio of these oscillations depends on the position of aircraft relative to glide path.

Each channel contains amplifier stages, diagram AGC, filters to 1300 and 2100 Hz rectifiers on semiconductor diodes at the output/yield of each filter. The loads of rectifiers are included towards each other. Therefore the resulting signal is equal to a difference in the output voltages of rectifiers, and its value and the polarity are determined by the amplitude ratio of signals 1300 and 2100 Hz, i.e., they depend on the position of aircraft relative to equisignal line.

Indicator circuit is supplied by the summed current of both rectifiers.

In mode/conditions "landing/fitting" the output/yield of course channel is connected to course system and KPP'S course blinker, but glide channel supplies glide system and the blinker of the same instrument.

The altitude sensor of DV-47 serves for the delivery of the voltage, the proportional to the current height/altitude H (t) flight of aircraft which in work in mode/conditions, "on" is compared with respect to value with the voltage, removed from functional potentiometer.

A difference in these voltages enters through the relay assembly to KPP'S horizontally deflection system. As a result of this, is provided the possibility of aircraft handling on zero-adjustment instrument during decrease from high altitudes (cloud penetration).

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sensor is by itself barometric type instrument.

Coupling unit with SP-50 is intended for the connection of the course and glide systems of the instruments of KPP, and also their indicator circuits either to the output/yield landing it dripped systems RSBP-2s or to the output/yields of the glide slope receivers of system SP-50. This makes it possible to utilize KPP'S the same instruments during landing/fitting using system SP-50 and during landing/fitting on decimeter beacons of the type "leg".

The coupling unit with SP-50 contains the group of the relays which by their contacts make all the necessary switchings. The relays are controlled by toggle switch to two positions "summary-SP-50". During setting toggle switch at position the "arch/summary" KPP are connected to the output/yield of the landing channel of system RSBN 2s, and at the position of "SP-50" - to the output/yields of the glide slope receivers of system SP-50.

Work of installed equipment in different mode/conditions. In

Fig. 157 the letters, which stand about junctions, characterize the information which transmits on these lines. Are accepted the following conventional designations: aaaa - the information about the instantaneous value of azimuth; aaaa - the information about the instantaneous value of range; aaaa - the information about the instantaneous value of height/altitude; aaaaa - the information about the instantaneous value of magnetic heading; H_3 is information about the rated value of height/altitude; aaaa - the information about the deflection of aircraft from Assigned Track Line with respect to course (in horizontal plane; aaaa - the information about the deflections of aircraft from Assigned Track Line by height (in vertical plane).

"navigation". 1. Mode/conditions is "KPP - off". This mode/conditions is selected by the function selector, arrange/located on the control panel of navigator. Trigger pulses with BD approach input the SZD which emits interrogation pulses. The code time interval and the frequency of high-frequency filling of interrogation pulses are determined by the number of the selected communication channel of communication, on which works onboard equipment. Interrogation pulses are re-emitted by ground-based radio beacon, also, through the time interval, equal to propagation time aaaa approach the input of receiver decay. The reciprocal

momentum/impulse/pulses of ground-based radio beacon also are the two-pulse coded premise/impulses, but code time interval and the frequency of filling in them others, than of interrogation pulses SZD. From the output/yield of receiver the decay decoded reciprocal momentum/impulse/pulses approach BD in which is measured the time interval between the inquiring and reciprocal momentum/impulse/pulses of aaaa.

The measuring unit of range issues the measured range in the form of the angle of rotation of the corresponding measuring axes. The result of measurement with the aid of synchronously the servo transmission approaches the counter of the range of PPDA, enumerated directly in the kilometers slant range.

Furthermore, to the input of receiver decay enter the signals of the azimuth part of the ground-based radio beacon, which include three sequences of the momentum/impulse/pulses: reference pulses "35", reference pulses "36" and azimuth momentum/impulse/pulses. Reference pulses "35" and "36" are the two-pulse coded premise/impulses which differ in terms of code interval. Azimuth momentum/impulse/pulses have dual bell-shaped form and comparatively large duration (approximately 24 ms). The frequency of filling both

of reference and azimuth momentum/impulse/pulses one and the same aaaa but differs from the frequency of filling of the ranging channel of aaaa.

After transformation in receiver decay all during the sequence of momentum/impulse/pulses through three separate channels enter BIA. The information about the azimuth of aircraft is included at the temporary situation of azimuth momentum/impulse/pulse relative to reference pulses (relative to "northern" agreement). In BIA by the measurement of the time interval between "northern" agreement and azimuth momentum/impulse/pulse is determined the azimuth of aircraft. The result of measurement is obtained in the form of the angle of rotation of the corresponding measuring axes which through the selsyn transmission approaches the azimuth part of the indicator of PPLA. Thus indicator PPDA issues present range and the azimuth of aircraft, and its readings they are utilized for determining the position oaircraft.

Fig. 167. Readings of KPP in flight of aircraft to radio beacon and from it. NP simultaneously onboard equipment works in the channel of ground-based indication. To the input of receiver decay at the frequency of the aaaa of ranging channel enter the three-pulse coded inquiring signals of the ground radio beacon, the so-called two-degree momentum/impulse/pulses. These signals simultaneously include the call signal of ground-based radio beacon. After decoding from the output/yield of receiver, the decay call signal is supplied through A.I.C. to telephones, and that pulses from the series of two-degree pules, which synchronizes with azimuth, is utilized for the starting/launching of SZD. In this case, SZD emits the three-pulse coded response signal to ground-based PPI.

Thus, in mode/conditions "KPP- off" in work participate the following assemblies of the given functional diagram: BD, SZD, decay, the channel selector, the function selector, indicator PPDA.

2. Mode/conditions of "Azimutt". For operational provisions in this mode/conditions on the selector of the azimuth which is arranged on the control panel of navigator, must be placed the assigned azimuth of aaaa.

In the process of flight in the block of performance, is solved equation (1) and is developed the voltage, proportional to the deflection of aircraft from Assigned Track Line. Through the function selector and the relay assembly, it is supplied to the deflection system of KPP'S course arrow/pointer. The need for having two separate mode/conditions: "Azimuth to" and "azimuth from" conditioned by the fact that during the deflection of aircraft from Assigned Track Line, for example, to the side of an increase in the azimuth (Fig. 167) in flight by radio beacon is required starboard turn in order to leave on Assigned Track Line, and in flight from radio beacon - to the left. In both mode/conditions the equipment works in perfect analogy, with the exception of the fact that with the aid of PRR changes the polarity of KPP'S connection to the output/yield of the block of performance.

In order that would work the diagram of prevention/warning about approach and about the flight/span of the assigned point, it is necessary to introduce range to it into the selector of range (i.e. into the selectors of azimuth and range are introduced the polar coordinates of the assigned point/item). In this case in the block of performance, simultaneously are solved equations (1) and (2) and in

accordance with conditions (9) and (10) are issued voltage on the diagram of signaling. Thus, in mode/conditions "azimuth", besides the indicated previously assemblies of functional diagram, in work are included the selectors of azimuth and orbit, the assembly of performance, relay assembly, KPP'S instruments.

3. Mode/conditions is "orbit left" or "orbit right". On the selectors of azimuth and range, must be put out the coordinates of the assigned point/item. The work of diagram occurs exactly as in mode/conditions "azimuth", only to KPP'S course system is supplied the voltage which is obtained in the assembly of performance during the solution to equation (2).

In work participate the same assemblies of functional diagram, as in mode/conditions "azimuth".

4. Mode/conditions SRP. On BU SRP must be put out the values of the coordinates of the assigned point/item of aaaaaaa and the given course angle of aaaa. If it is necessary that at the appropriate torque/moment would actuate/operate signaling about approach and flight/span of the assigned point/item, then the coordinates of this

point/item must be also introduced into the selectors of azimuth and orbit. The coordinates, introduced in BU SRP and the selectors of azimuth and range, can be either identical, if is necessary prevention/warning about approach to the end point of route or different, if it is necessary to note any intermediate point of route. Value prevention/warnings and signalings they work exactly as in mode/conditions "azimuth" and "orbit".

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In the process of flight in side-looking on SRP according to datum, introduced in Bu SRP, and datum, on that enter from BD and BIA, is solved equation (8). The obtained as a result of this voltage, proportional to the deflection of aircraft from Assigned Track Line, through the PRR and the relay assembly approaches the deflection system of KPP'S vertical arrow/pointer.

In this mode/conditions in supplement to previously indicated assemblies, is included by SRP.

Landing/fitting 1. Landing/fitting on the radio beacons of system SP-50. The data reduction mode/conditions is realized by a toggle switch the "arch/summary - the SP-50", which must be established/installed at the position of "SP50".

The signals of ground-based landing beacons are accepted and are processed KRP and GRM. The voltages from their output/yields, which characterize the position of aircraft relative to glide path, through the coupling unit with SP-50, approach KPP'S indicator. Thus, from entire assembly of installed equipment RSBN 2s is utilized KPP'S only indicator.

2. Landing/fitting on radio beacons of the type "leg". This mode/conditions can be selected both on the control panel of navigator with the aid of PRR and on pilot's panel by toggle switch "landing/fitting".

The signals of decimeter landing beacons are accepted receivers decay. From the output/yield of the detector of this receiver, the voltages enter the channel of landing signals, at output/yield of which are obtained the voltages, which characterize the position of

aircraft relative to glide path. These voltages through the relay assembly PRR and the coupling unit with the SP-50 course and glide system of KPP'S indicator.

Consequently, in this mode/conditions work the following assemblies of functional diagram: receiver decay, the channel of landing signals, relay assembly, coupling unit with SP-50, KPP'S null-indicator.

Mode/conditions "on" is included by toggle switch "tbd", arrange/located on the panel of navigator's administration. In this case of the voltage from functional potentiometer, which is located in BD, proportional to base altitude, through the relay assembly is supplied to the cell/element of comparison. To it enters from the altitude sersor of DV-47 the voltage, proportional to the current height/altitude. The resulting signal, which characterizes the deflection of aircraft from line tbd, approaches KPP'S glide system.

It should be noted that the channel of ranging measures and issues present range both in the mode/conditions "navigation" and in mode/conditions "landing/fitting". Therefore mode/conditions "tbd"

can be involved together with any of the indicated mode/conditions.

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TAKEN ABRIDGEMENTS.

AFC - automatic frequency control;

BA - bearing unit;

BD - range unit;

BKC - the unit of the inspection of frequency;

wove, i.e., high-voltage rectifier;

VI - rectifier PPI;

VNNO- the rectifier of responder's ground-based receiver;

VPOD - the rectifier of the receiver of the responder of range finder

dripped the upper and lower angles;

VWDA - the rectifier of encoder;

GKS - the generator of the quartz signals;

DZD - a supplementary delay in the range finder;

DWKA - the decoder of supervisory equipment;

DWO - responder's decoder;

DWP - the decoder of receiver;

DWRD - the decoder of the repeater of range finder;

SZD - the inquisitor of range;

SI - signals PPI;

sodas - the aircraft responder of range;

SNAD - the aircraft receiver of azimuth and range-finders signal;

SRP - computer;

UVA - roll control of antenna;

PPI - plan position indicator;

IPM-2I - the meter of passage power;

kA - supervisory equipment;

KVP - control ext ension point/item;

KND - the inspection of zero of range;

- the combined flight instrument;

KUA - the inspection of setting azimuth;

NPO - responder's ground-based receiver;

NPU - ground-based receptor;

OZ - the limitation of charging;

hearth - the receiver of the responder of the range finder of the channel of the upper and lower angles;

PPDA - the directly reading instrument of range and pilot's azimuth;

PPDA-W - the directly reading instrument of range and navigator's azimuth;

PU - adapter;

UPCh - the amplifier of intermediate frequency;

UPC-AK - the IF amplifier of ranging channel;

UPC-DK - the IF amplifier of ranging channel;

WDA - encoder;

ShchU - the control panel of pilot;

ShchUSh - the control panel of navigator.

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